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Lighting Equipment and Fixtures for Banking Houses

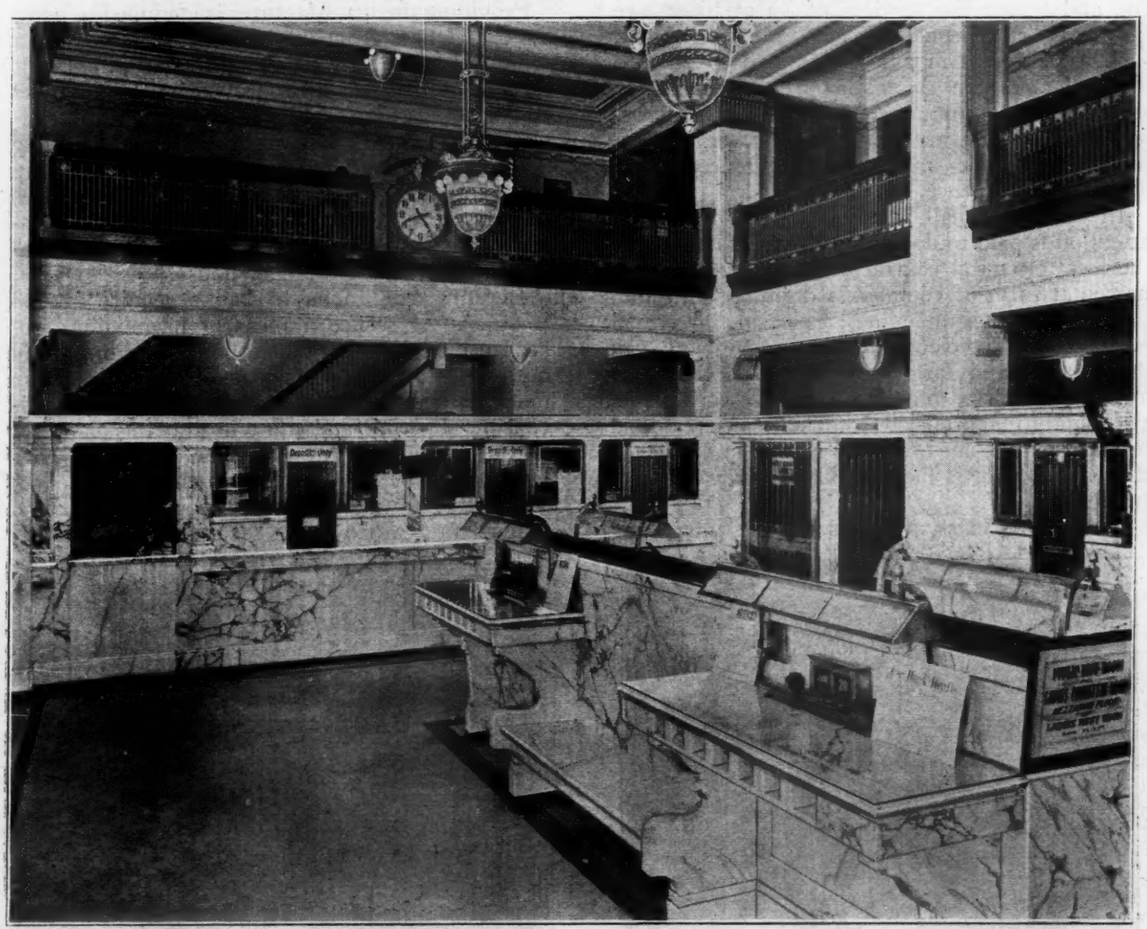
Substantial Fixtures Made of Good Materials and Producing Pleasing Effects Required in Banking Institutions — Proper Lighting Necessary—Harmony Between Architecture and Fixtures Essential

By H. K. FIRTH

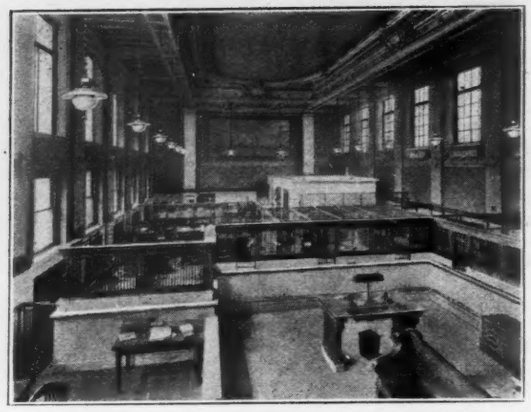
Sales Department, Beardslee Chandelier Manufacturing Co., Chicago.

The lighting of banks and the selling of bank-lighting equipment is undoubtedly one of the most satisfactory and business-like undertakings in which the electrical contractor participates. The sale is generally made to the board of directors, a building committee selected from the board of directors, or to the bank president. Hence, the seller deals with men who know business and are favorably impressed with a straight business-like proposition.

It is safe to say that 999 out of every 1000 bank-lighting installations are sold entirely on merit. Personal or business friendship may help some in a small town, but in the great majority of



Public Space and Check Desks in City Bank of Battle Creek (Mich.) Lighted With Fixtures That Harmonize With Other Interior Finish.



View in Federal Reserve Bank at Louisville, Ky.

cases the reputation of the manufacturer, the quality of the goods and the ability of the contractor to install a first-class job are the prime considerations. The cost of lighting equipment is usually so small, compared with cost of the building and the interior furnishings, that price is seldom a deciding factor.

Banking Houses Divided Into Three Separate Types.

Banking institutions, as users of lighting fixtures, may be divided into three classes: first, the small-town or neighborhood bank which is outfitted by the bank-screen and desk manufacturers, and where the services of an architect are not necessary; second, the moderate sized bank, such as is found in cities of 15,000 to 200,000 population, where the plans are drawn by an architect whose influence is noticeable in the selection of equipment; and, third, the very largest banks where the architect's preference is the dominating influence.

In the very small bank, as a rule, not much attention is paid to decorations and details; hence the local electrical contractor can suggest an ornamental form of commercial lighting unit, and, providing it has simple lines, a pleasing effect will be secured. Sufficient outlets to provide an even distribution and large enough lamps to give adequate intensity must, of course, be considered. Frequently inappropriate combinations are found in small banks, but often the man who furnished the bank screen is more to blame than the electrical man.

The second class of banks is more interesting to the fixture man than the first and third, principally because they are the most numerous and represent business that can be handled by the reputable electrical contractor. Usually the electrical man can secure the chandelier order by the following procedure:

Call on the architect and bank directors or bank president, and secure from the architect a set of plans and some idea of the total cost of the building and the appropriation for lighting equipment. Then get in touch with some reputable chandelier manufacturer who has a capable staff of designers, and give them the plans and all facts pertinent to the job. The manufacturer will be able to tell whether the job warrants the service of one of his salesmen or not. If the plans and appropriation call for comparatively simple and inexpensive equipment he will probably send complete sketches to the contractor and let him secure the order. If, on the other hand, the plans call for original designs and special treatment he will send out a salesman qualified to cope with the situation. Much depends on the ability of the manufacturer's designer, and electrical contractors should bear in mind that it is just as necessary to have the services of a designer thoroughly familiar with all the styles of architecture and decoration as it is necessary for the bank to have an architect.

Bank Lighting Usually Requires Best of Fixtures.

Providing the manufacturer is equipped to build the chandeliers from the best materials, and at a reasonable price, the capable designer will submit sketches which will be approved by the architect and which can be sold by the salesman and contractor. In nine out of ten cases banks will buy good material well made in preference to cheap material, and the electrical contractor who desires this class of business will do well to acquaint himself with the manufacturing facilities and designing ability of his chandelier house.

Lighting conditions in banks require special treatment to secure a pleasing harmonious appearance of dignified tone. Bank interiors are in most cases of massive proportions and finished in modest tones. The designing architect spends considerable time and study in drawing plans for the interior, and a proportionate amount of time should be spent by the chandelier designer to make the lighting equipment equally attractive. The main feature to be secured is satisfactory

Lighting Fixture Installation in Bank at Dubuque, Ia.

View in Main Room of Westby (Wis.) State Bank.

View in Offices of Louisville (Ky.) Clearing House.

illumination without the flash and glare so often seen in commercial installations.

The City Bank of Battle Creek (Mich.) is typical in size and equipment of the second type of banks. The lighting equipment is of the classic period, thoroughly in keeping with the architectural detail and decoration of the interior. Three 15-light electroliers form the principal lighting units for the lobby. A brown-toned calcite bowl which incloses three of the lights is held by a cast-bronze band with cast-bronze ornaments, while below the band and around the bowl are 12 round frosted lamps. The bowl and the band with its ornaments are suspended by four ornamental round supports.

Units of Similar Design Produce Pleasing Effects.

On the mezzanine floor and at the entrance to the directors' room a ceiling-type modification of the large unit is used. It has the same glassware, decorations and details, but is made in a smaller size. Under the mezzanine floor a pendent unit is used. It is also of the same design as the large unit, but has smaller supports and glassware. The entrance to the office part of the building and the vestibule are visible from the bank; therefore in order to present a harmonious appearance throughout electroliers similar to the lobby units were used.

Check desks usually require some form of lighting of sufficient intensity to meet the needs of the public. The four check desks are lighted with heavy cast-bronze brackets of three lights each. The lamps have opal-glass reflectors cov-

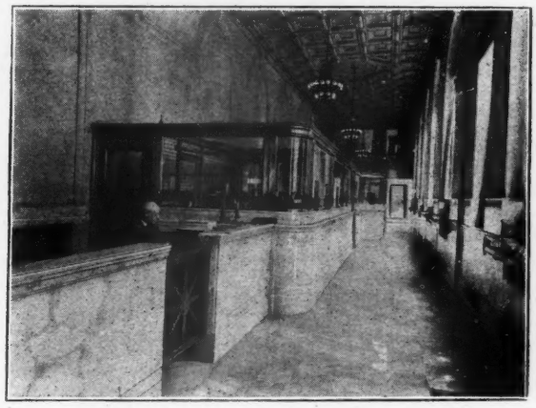
Offices of Louisville (Ky.) Clearing House.

ered with art glass, the colors harmonizing with the decorations.

The president's, vice-president's and cashier's offices are lighted with semi-indirect bowls of the same glass decorated in the same period as the lobby units. The directors' room is located adjacent to the mezzanine floor, and above the directors' table are two five-light indirect chandeliers having five arms each and which carry vertical shades.

Illumination at Bank Screen Requires Special Treatment.

Rapid accurate work must be done at the bank screen; hence, sufficient illumination must be provided for the teller and customers. This is best accomplished by using a reflector which conforms to the construction of the bank screen. The reflector should be inconspicuous and must be designed for lighting results and not for ornamentation. Harsh shadows and glare must be eliminated. The City Bank of Battle Creek has a



Public Space in Bank of Jamestown, N. Y.

continuous reflector running the entire length of the bank screen. This gives ample illumination and does away with unsightly desk standards which are so often a source of inconvenience and annoyance.

From the foregoing it will be seen that the lighting of a bank in an average-sized city is a worth-while task, and the dignity of the installation should be a source of pride to the contractor and his organization.

ONTARIO PLANS TO BUY MACKENZIE POWER PLANTS.

Advices from Toronto, Can., indicate that a deal, subject only to ratification by the Ontario government, was completed Dec. 4 for the purchase by the province for $32,734,000 of most of the Mackenzie power interests in and around Toronto. The Toronto street railway is the only one of the enterprises not included in the transaction. The deal means that with the exception of the Dominion Power Co. at Hamilton, all the larger hydroelectric concerns in the province will be public property. The date of the bargain is made as of Dec. 1. There will be no immediate cash payment, bonds guaranteed by the Ontario government being the principal consideration at this time.

Central-Station Methods for Improving Store Lighting

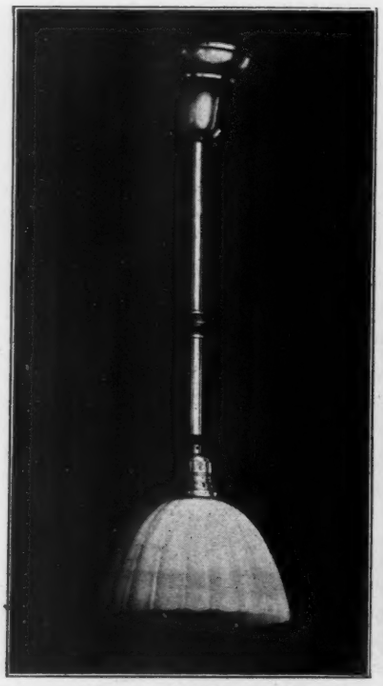
Rearranging Lighting Installations and Changing Old Types of Commercial Fixtures to Get Efficient Lighting Described and Illustrated in Paper Before Illuminating Engineering Society

By O. R. HOGUE, J. J. KIRK and E. D. TILLSON
Commonwealth Edison Co., Chicago.

There has been an unusual amount of material written on the subject of industrial lighting during the last few years. Evolved from this mass of discussion are the various state codes wherein are laid down sets of rules for guidance towards better illumination. It was not so many years ago that it was frequently asked whether reflector manufacturers should or should not produce a standard reflector equipment for industrial lighting. Some lighting men said "No," and again many more said "Yes." Today there are thousands upon thousands of industrial establishments equipped with RLM reflectors which are in use day after day, but no one attempts to say that the RLM reflector is not a success. Now that the sale of this standard equipment has shown tremendous increases over all other equipment, perhaps there is something in this experience which may be applicable to other branches of the lighting field.

As compared with industrial lighting, store or commercial lighting has received but little attention, and may therefore be said to be one of the most backward for that reason. Leading spirits in the commercial fixture industry frankly recognize and freely admit that they have been lax in their efforts to standardize their products. This has happened because of the keen competition between rival manufacturers; they individually developed types of fixtures which they believed to be the correct solutions for commercial lighting. This has caused them to spend large sums of money in promotional work to convince the buying public that they are right, and the intense individual activity has so taken their time and energy that they have overlooked the possibilities and advantages of combining their efforts towards some standard development. As a result store lighting equipment today is in very much the same position it was five or ten years ago. Results can be enormously influenced and better relations can perhaps be permanently established if attempts to find a common ground will be made, as have been done in the industrial lighting field.

The advantage of good lighting in industrial establishments is now well recognized. Every factory owner knows that improved lighting means more and better production, and all that goes with it. The advantage of good illumination



Type of Standard Store Lighting Fixture No. 632 Changed to Accommodate Type C Lamps.

Another Adaptation of Standard Store Fixture No. 632 for Use With Type C Lamps.

Old Style Fixture Adapted for Semi-Indirect Lighting and Equipped With Pull Chain.

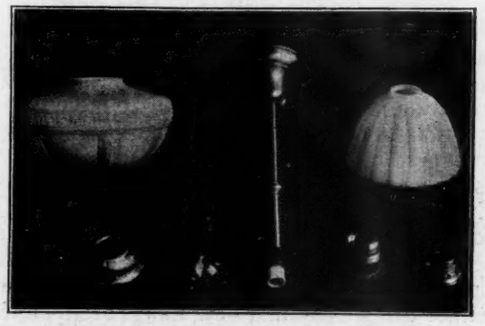
can be shown to be as beneficial to the store owner as has been demonstrated to the factory owner.

We and others believe that merchandise can be sold more easily and quickly under artificial light than under daylight conditions. For the benefit of the merchant, the central-station company and the cause of better illumination, and in order that this may be proven to be a general fact, we suggest that the Illuminating Engineering Society undertake an investigation along this line. The establishment of such fact will go far to bring commercial lighting to that more advanced plane held by industrial lighting.

High-Intensity Illumination Aids in Merchandising Goods.

An engineer employed by one of the largest department stores in Chicago in a recent discussion before the Illuminating Engineering Society remarked that when the store management wished to dispose of a line of goods, they were moved to a section where lighting intensities were many times higher than prevailed generally throughout the store. Instinctively they must have realized that the psychological effect of the increased intensity would have its result in moving the merchandise.

The progressive merchant knows the value of high intensity lighting in windows as an attracting medium, and hence, its advertising value to his store. Similarly he knows that the proper lighting of his store interior will draw the public inside. We have not yet designed standard equipment with which he can obtain within his store the results which he has a right to expect.

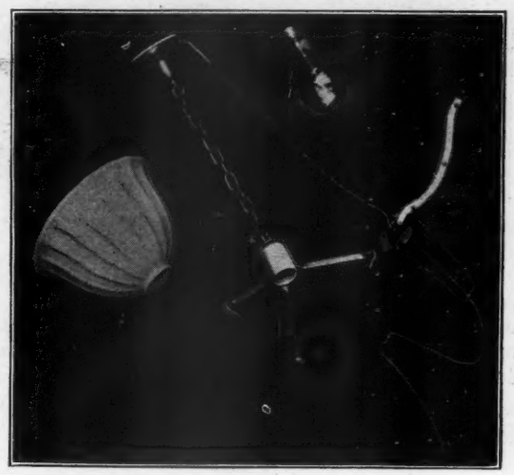


Different Parts of Standard Fixture No. 632 and of Adapted Lighting Unit.

Granted that the longer use of higher intensity artificial lighting does increase sales, the Illuminating Engineering Society should place itself in a position to collect data that will establish this fact. Such data could be used by the electrical trade in promoting campaigns for better store lighting.

Having a conviction that store owners would materially benefit by the increased use of artificial lighting, a campaign for better store lighting has been inaugurated by the Commonwealth Edison Co. in Chicago. Realizing that the cost of new fixtures is prohibitive to the average storekeeper under present market conditions and knowing that they would not consider new equipment due to its high cost, it was the aim of the company to make this change as easy and as reasonable in cash as possible. Since the company has some 20,000 fixtures of a standard design installed in customers' premises for use with type B lamps and not adaptable for use with the type C lamps it was decided to rehabilitate the present equipment. This rehabilitated fixture was so designed as to conform with present practice in good lighting.

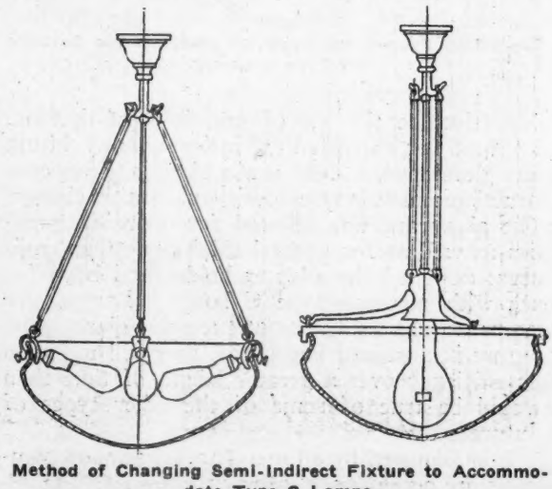
To meet a demand for true semi-indirect lighting our engineers designed a spider adapter with



Different Parts of Adapted Fixture, Showing Pull-Chain Attachment.

bowl clips to be used in connection with the Sudan bowl No. 6025. This bowl has a pleasing contour and its density is such as to cause a low surface brightness and its color tone tends to improve the general appearance of the store interior. This equipment is applicable to interiors with light colored ceilings or where it is possible to readily resurface the ceiling.

A feature which has been applied to this type of equipment adds to its usefulness and avoids the necessity of frequent cleaning which ordinarily is necessary with this type of fixture. It is known as the "pull-chain attachment." A squegee makes a complete revolution around the interior of the glass bowl, operating simultaneously with the pull-chain switch. As the fixture is individually controlled, it is impossible to turn the unit on or off without cleaning the bowl. The accompanying illustrations show how two styles

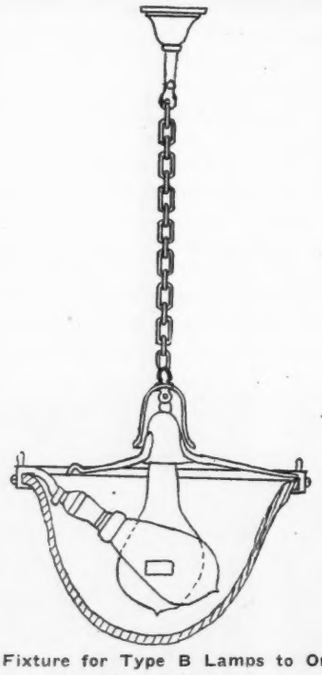


Method of Changing Semi-Indirect Fixture to Accommodate Type C Lamps.

Views of Restaurant Before and After Fixtures Were Changed to Correspond With Modern Practice in Lighting.

of semi-indirect lighting units designed for the use of type B lamps have been reconstructed to use type C lamps with a resultant higher intensity on the work and an improvement in the appearance of the fixture.

By far the majority of the stores having old style direct lighting units do not readily lend



Converting Fixture for Type B Lamps to One Suitable for Type C Lamps.

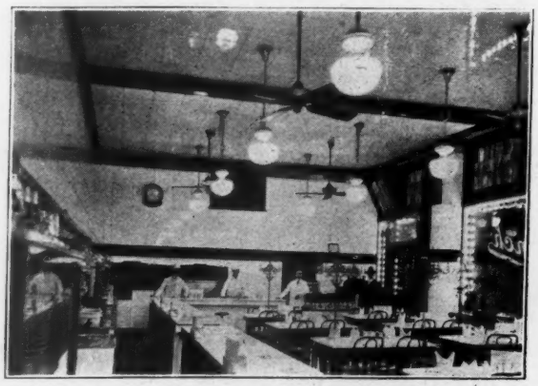
themselves to the use of semi-indirect lighting. To meet this condition the inclosing-bowl fixture was developed. Here again simplicity of construction and beauty of design mark this change. The glassware was selected for diffusing qualities as well as for general efficiency. Our engineers designed the adapter holder and bowl for use with 300-watt type C lamps. Larger size lamps may be used without excessive glare. The fixture is dust and bug proof, and will maintain its efficiency over a greater length of time than would be true of some of the other types of fixtures.

It is admitted by all merchants that show windows are necessary to display their wares. However, there is only one kind of a successful window, and that is the kind that sells goods. A show window is a merchant's point of contact with the general public. He cannot hope to attract the attention of the passerby unless his windows are properly lighted. There is an old adage "seeing is believing," and goods well shown are half sold. It is not the newer stores that need attention; rather it is those stores where only one outlet has been provided for the lighting of the windows.

Special Tubing for Wiring Outlets

The cost of wiring outlets for concealed lighting has deterred many a desire on the merchant's part to improve his display. This objection is met by the use of special tubing which the merchant can obtain, at low cost, including complete equipment with all the necessary fittings. The connection of the wires to the lighting circuits in the building is readily made and entails only a very slight expense as compared with old methods of wiring.

Much credit for exposing the necessity for good lighting belongs to the Illuminating Engineering Society. The public does not demand improvements; in fact, it often resists them. Neither can we say that new things are manufactured to supply a demand. There is no demand. Both the demand and the goods must be created. People have always clung to old-fashioned discomforts until some enterprising salesman persuaded them otherwise.



Night View of Restaurant—Ten 300-Watt Units Give Mean Value of 11 Foot-Candles.

Standardization and Co-operation in the Fixture Trade

National Council of Fixture Manufacturers Working for the Introduction of Standardized Designs of Certain Parts and to Eliminate Unsound Trade Practices—Fixture Market Already Planned

By V. D. GREEN

Publicity Manager, National Council of Lighting Fixture Manufacturers.

Co-operation is the road to success in any industry. It is particularly necessary in the lighting-fixture business with its vast ramifications stretching throughout the country and involving a yearly expenditure estimated recently by one authority at over $200,000,000. This same vastness of scope, however, made it evident to a few far-sighted fixture manufacturers that the time had come to create a national organization which would serve as a rallying point for the co-operative spirit among the manufacturers and also work together with the Lighting Fixture Dealers' Society in making and enforcing regulations for the good of the fixture industry in general, and for collecting and disseminating among manufacturers and dealers information on subjects of interest. These subjects would naturally include recent improvements in shop practice, better methods of cost finding and selling, suggestions for the standardization of parts and fixtures, and any other matters which would tend to improve the status of the fixture business.

Organization Intended to Eliminate Unsound Trade Practice.

The National Council of Lighting Fixture Manufacturers was the result. One of its earliest tasks was the exposure and suppression of many abuses which had gradually crept into the trade. Among these abuses were various forms of unsound trading and competition. There had long been a feeling among the members of the trade that these evils should be wiped out, but the difficulty was that there was a tendency to let someone else make the start. Now, however, that the National Council has stepped forward to act for all, and has drawn up definite suggestions and regulations for the prevention of such acts, there is but little doubt that the unsound practices will be looked upon by the entire trade in their true light and will be eliminated.

A standardized method of cost keeping—another task which the National Council has in view—will not only show fixture men how to eliminate the leaks in their selling and manufacturing organization, but will also enable the manufacturer with up-to-the-minute equipment and organization to reap the full benefit of his enterprise. Moreover, the present price situation in which practically identical fittings are sold at widely differing prices will thus be relieved.

There are today dozens of successful manufacturers and dealers who might be still more successful than they now are if they realized that some of the lines handled are actually losing money for them, and that their business as a whole is satisfactory only because the margin of profit on certain other items of their stock or products is unreasonably large. An accurate system of cost keeping would enable these men either to arrange to distribute their selling costs proportionately, and thus make each article sold bear its correct share of the selling expense.

Standardization of Parts a Desirable Move Towards Economy.

Another important part of the National Council's work is endeavoring to arrange a basis of agreement between makers to standardize the various parts of which their fixtures are composed. Every dealer knows the drawbacks of the present unstandardized condition of the trade. Lamp sockets, for instance, are made in a dozen or more different forms, not one of which is interchangeable with any other. Shades obtained from one maker often will not fit the shade rings of another. Even the screws which go to make up the fixture parts are not standard either as regards threads or diameters. It is usually quicker and cheaper to scrap the entire part than to try to replace even a single screw.

The National Council is endeavoring to standardize fixture parts as far as possible—and that is probably much further than many will at this time consider even within the bounds of possibility. Standardization is an accomplished fact in the automobile industry, as regards all important details of mechanical construction, in spite of the wide diversity of cars in use. Why cannot a similar uniformity in such details be arranged for in the fixture industry? The National Council believes there is no reason why it cannot if all of us—dealers and manufacturers alike—get together about it.

Manufacturers and Dealers Have Common Interests.

Such a large task as the standardizing of a whole industry will naturally take time. At the present time the council's engineer is collecting and classifying data on the various types of lamp sockets on the market. When these are complete he will draft out a socket design embodying the good features of all as far as possible, and samples will be made up and sent out to the various member firms of the council, inviting suggestions and criticism for still further improvements. From these a standard socket acceptable to all will be evolved.

The National Council, however, realizes also

the necessity of co-operating with the dealers. So impressed are its members with the importance of assisting in building up a strong dealer organization that they are carrying out through their own salesmen a drive to secure among their customers membership subscriptions for the Lighting Fixture Dealers' Society of America.

Lighting Fixture Market at Buffalo.

The annual fixture market—another recent innovation of the National Council—has been the means of bringing together the dealers and manufacturers in a way which could hardly have been effected so satisfactorily otherwise. There it is possible for the fixture dealers to see the latest designs, and to meet on a friendly footing men on the manufacturing side of the business. They are thus enabled to hear and understand the viewpoint of "the other fellow" on matters affecting the good of the industry. The annual lighting fixture market thus bids fair to become one of the greatest helps towards securing co-operation within the fixture trade which has yet been evolved.

Those who were at the Detroit fixture market last year will agree that the National Council must make a splendid showing in order to beat their own record last year. Yet that is just what the members of the executive committee are going to try to do. They have profited by the lessons of the Detroit market, one of the chief of these lessons being that even the space then provided was not sufficient to accommodate all those who wished to show their products. This year they have secured the great Elmwood music hall at Buffalo, N. Y., and are going to spend some $10,000 in order to make possible an even more extensive gathering than the one of last year in Detroit. The Council's secretary has already sent out to all members the plans of the hall, together with full details as to the booth arrangements, and will give any further information desired. The market is to be in full swing from Feb. 14 to 19 inclusive. The fixture market this year is expected to be the largest assembly of lighting fixtures, illuminating glassware, shades and lighting novelties ever collected under one roof.

STREET LIGHTING WITH ORNAMENTAL POSTS IN PASADENA.

Installation Costs Were Charged to the Property Owners and Operating Expenses Are Paid by the City.

Streets in Pasadena, Cal., are illuminated effectively, using equipment that is ornamental as well as useful and efficient. The units shown in the illustration are of what is commonly known as the boulevard type, and are equipped with 80-candlepower, 6.6-ampere, type C lamps. A staggered spacing of 75 ft. is maintained in connection with these units, the height of the lamp above the pavement being 10 ft. 6 ins. Installation costs ranged from $0.65 to $0.80 per front foot of property at the time the system was erected. Present-day prices would involve a cost somewhat in excess of these figures.

Novalux units, using 400 and 600-candlepower type C lamps rated at 15 and 20 amperes, are placed in location where a greater volume of illumination is required. These units are mounted 13 ft. 6 ins. above the ground, and are spaced in accordance with the requirements of the location. The Novalux equipment cost a total of from $1.10 to $1.35 per front foot. Power for operating the system is purchased at a price of $0.0325 per kw-hr. plus the cost of lamp renewals.

Special arrangement of units at street intersections and at driveways adds much to the pleasing appearance of the system as a whole. Backgrounds of trees along the streets serve to set off the lights at night and enhance the beauty of the system itself. The larger units, set at appropriate places, give variety to the system as well as supplying the extra needed illumination.

Street View in Pasadena, Cal., Showing Ornamental Lamps.

Control Equipment for Direct-Current Motors

Third of a Series of Articles on Application of Motor-Control Apparatus — Fundamental Principles — Armature and Field-Resistance Controls — Discussion of Various Other Methods

By G. J. KIRKGASSER and E. W. SEEGER

The entire subject of direct-current motor control, with the exception of one or two special cases, may be reduced to one principle: the placing in circuit or the cutting out of circuit of resistance with connections so arranged that the changes may be made in a few or many steps.

The circuit referred to may be the armature circuit or the field circuit of the motor. The resistance unit, which is more properly termed the resistor, may be of many types.

Starting a Direct-Current Motor.—To illustrate the principle of starting or accelerating a direct-current motor, take the case of the ordinary hand-operated starter which has its resistor arranged as shown in Fig. 13. As the hand lever is moved over the buttons different sections of the resistor are cut out of circuit. When the lever is at the extreme right-hand position all of the resistors are disconnected from the circuit.

To further illustrate this fundamental principle, the elementary drawing, Fig. 14, is presented. With the lever resting on the first button all seven resistors are included in the circuit (the number is assumed just for bringing out the idea, for there may be less or more or different types of resistors). Button 2 would eliminate resistor 1; button 3, resistor 2, and so on until finally all of the resistors are eliminated.

When a direct-current motor operates, voltage is generated the same as when the armature of a generator is rotated, because of the fact that the armature conductors pass through the magnetic field set up by the field poles. In the case of the motor the voltage is in a direction opposite to that of the supply voltage, and is known as counter e.m.f. It varies with the rate that the conductors travel, or, in other words, with the speed of the motor. At standstill no counter e.m.f. is generated; at slow speed it has a small value, gradually increasing with the speed, until at normal running speed it nearly equals the impressed voltage.

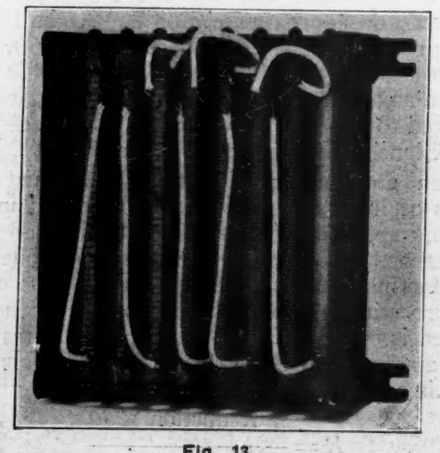


Fig. 13.

Illustrating the mounting of resistors with a small type of face-plate starter. The slate front is removed to show the resistors, the loops on the wires being made to form the connections to the contact segments which appear on the front of the face.

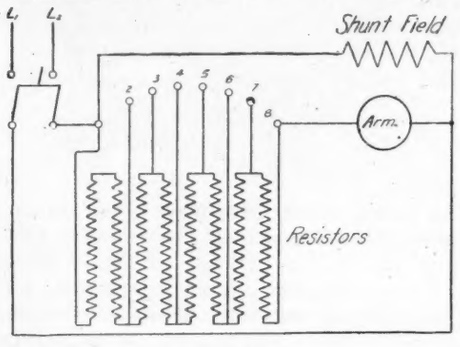


Fig. 14.

Elementary diagram to indicate the arrangement of resistors and means of acceleration.

The above simple but basic facts explain why it is necessary when starting a direct-current motor to insert resistance in series with the armature. Since no counter e.m.f. is present to oppose the line voltage, a resistor is used to reduce the voltage across the armature terminals and so protect the armature from excessive current which might cause burnouts and damage to the brushes and commutator. Also, the sudden start caused by the high torque might injure the machine to which the motor is connected.

The formula

$$I_a = \frac{E_l - E_c}{R_a}$$

in which I_a is the armature current, E_l the line voltage, E_c the counter e.m.f., and R_a the armature resistance, shows the significance of this principle. If a line pressure of 220 volts is assumed, a motor with an armature circuit resistance of 2 ohms, and a counter e.m.f. at standstill of 0, the armature current will be

$$\frac{220 - 0}{2} = 110 \text{ amperes.}$$

If the counter e.m.f. were 20 volts, the initial current (100 amperes) would still be excessive. A resistance of 20 ohms in the armature circuit would result in a starting current of 10 amperes, which is a safe value. As the motor armature

revolves and the counter e.m.f. increases, the inserted resistance may be reduced, which is what happens when the handle on a small hand-operated motor starter is moved toward the right over several buttons or segments.

As an example, assume that the motor has speeded up until it is developing a counter e.m.f. of 100 volts, and the extra resistance is reduced from 20 to 10 ohms. The value of the armature current would then be

$$I_a = \frac{220 - 100}{2 + 10} = 10 \text{ amperes.}$$

The above values are taken approximately, but they illustrate the principle. The resistance is connected external to the armature, with the exception, of course, of the resistance of the armature conductors, brush contacts, terminals, etc., which were assumed as totalling 2 ohms.

With the motor at normal speed all external resistance located in the starting box is out of circuit and the counter e.m.f. is near the impressed voltage in value.

$$I_a = \frac{220 - 206}{2} = 7 \text{ amperes.}$$

The action which takes place when starting up a shunt or compound motor is shown graphically in Fig. 15. A line voltage of 220 is assumed, with a total armature circuit resistance of 2 ohms and an external resistance in the starting box of 20 ohms, so that the starting current is approximately 10 amperes, as indicated at the point *A*. If this current is sufficient to start the motor it will accelerate along the line *AX*. If it is assumed that the motor is fully loaded, it will only be able to accelerate to the point *B* with all resistance in circuit. When the first step of resistance is eliminated a second current rise is obtained, as indicated at the point *C*, and the motor then accelerates along the line *CX*. When the point *D* is reached another step of resistance is eliminated, and so on until the motor is up to speed.

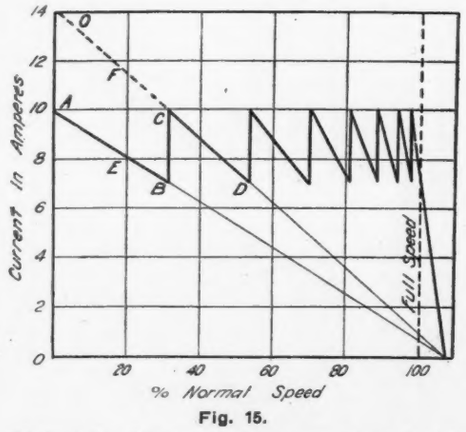


Fig. 15.

Graphic chart showing how the current varies during the acceleration period of a motor.

If the first step of resistance is eliminated before the point *B* is reached, the second current rise will be greater than that indicated by the point *C*. If the first step is eliminated when the motor accelerates to the point *E* the second peak will go to the point *F*. If the motor does not start on the first point the starting current on the second point will be approximately 14 amperes as indicated at the point *O*.

As a matter of fact, the starting currents usually obtained in practice are much less than those

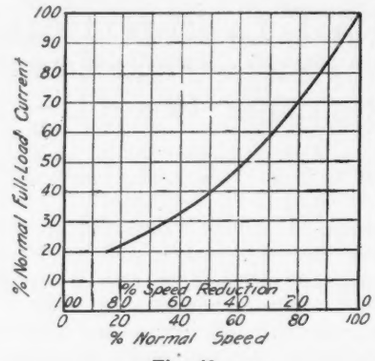


Fig. 16.

Characteristic curve of a motor driving a fan. The current required increases rapidly with the increased speed.

indicated on the curves. A motor circuit is highly inductive, especially if the motor has a series field, and for this reason the current builds up slowly. The motor starts to revolve before the maximum value of current is reached, and after the motor is started the counter e.m.f. helps to limit the current value.

Speed Regulation by Armature Control.—The most common method of regulating the speed of a direct-current motor is by placing resistance in series with the armature circuit. The action obtained is the same as that shown in Fig. 15. The only difference is that when a speed regulator is used the motor is allowed to operate with the resistance in circuit. It is apparent from the curves that the amount of speed reduction obtained with a given resistance is proportional to the load; that is, the reduction at full load is about twice that at half load. Take the case of the motor previously discussed. The resistance of the armature circuit was 2 ohms, the full-load current 7 amperes, and the counter e.m.f. at full load 206 volts. With a speed-regulating resistance of 20 ohms the drop across the resistance at full load is 140 volts and the speed reduction is 140/206, or approximately 68%. At half load the current is about 3.5 amperes, the drop across the resistance 70 volts, and the speed reduction only about 34%. If the regulating resistance is reduced to 10 ohms instead of 20 ohms the speed reduction is one-half of the above values.

Fan and Machine Duty.—There are two types of loads which must be considered in designing speed regulators of the armature-resistance type. Machine-duty or constant-torque regulators include those used with machine tools, reciprocating pumps, etc., when the torque required is constant for all speeds. With this type the amount of resistance required can be approximated from the formula:

$$R = \frac{\% \text{ Reduction} \times E}{I}$$

where R is the resistance, E the line voltage and I the normal full-load current. The resistance

for this type of load must be designed to withstand full-load current continuously. Fan-duty regulators are those used with centrifugal pumps, fans and other machines where the torque required varies with the speed. In this case the calculation of the resistance is a little more difficult. Fig. 16 shows the characteristic curve of a fan. It will be noted that the current required increases rapidly as the speed increases. Suppose it is desired to obtain a 50% reduction in speed. At 50% speed the current is only 40% of normal, and it is therefore necessary to provide a resistance of high enough value to get the necessary voltage drop at this low current. The resistance in this case will be approximately:

$$R = \frac{0.5E}{0.4I} = \frac{1.25E}{I}$$

At 25% reduction in speed the current is 65% of normal, and the resistance required will be:

$$R = \frac{0.25E}{0.65I} = \frac{0.38E}{I}$$

Due to the fact that the current required by a fan varies at different speeds it is necessary to make the percentage of full-load current capacity only 40% of normal current at 50% reduction, 65% at 25% reduction, and so on, as shown by the curve.

Low Efficiency of Armature-Resistance Control.—Speed regulation by armature control is used chiefly because of its simplicity and because this type of control can be applied to almost any standard direct-current motor. This method is, however, extremely inefficient. Take the case of a 10-hp. motor driving a constant-torque load and operating at 50% speed reduction. The power taken from the line is, of course, 10 hp. The power delivered to the machine is only 5 hp. because the torque is constant and the motor is only revolving at half speed. The other 5 hp. is lost and is dissipated as heat by the regulating resistance. If such an equipment operated 45 hours a week and the price of power 2 cents a kw-hr., the total loss in one year would be nearly $175. This is an extreme case, but it shows that it is worth while to consider putting a little more money into the first cost of motor and controller in order to improve its efficiency.

There are some cases where it is considered good engineering practice to use armature resistance. The power loss is not serious if the speed reduction is small, if the motor is run at reduced speed only infrequently, or if the motor is operated intermittently.

Speed Control by Field Resistance.—A more efficient method of speed control is obtained by varying external resistance in the shunt-field circuit. In this case the only rheostatic loss is in the field resistor, and as the total power loss in the shunt-field circuit does not usually exceed 5% the field-rheostat loss is negligible. Another decided advantage of this method of control is that for any setting of the regulator the speed is practically constant for all loads.

The resistance to be inserted in the field circuit to obtain a given speed increase cannot be accurately predetermined, but must be found by test for each individual motor. This is due to variations in manufacture, such as resistance of field coils, length of air gaps, quality of iron, etc. It is often found that motors built to the same specifications require widely different values of resistance to produce the same increases in speed.

Nearly all standard constant-speed motors can be safely operated at 10 or 15% above normal speed, but where the speed increase is greater than this amount a motor designed especially to meet these requirements is necessary. Such a motor usually has a strong field at slow speeds, so that when the field is weakened to obtain higher speeds satisfactory operation can be obtained. These motors are more expensive than the standard constant-speed type, but the higher first cost is usually more than offset by the lower power consumption.

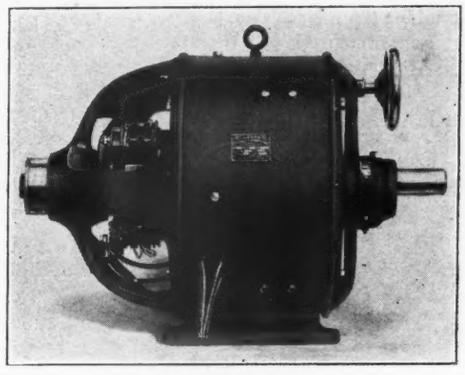


Fig. 17.

The handwheel shown mounted on the Reliance motor allows for shifting the armature, which results in varying the speed.

Multivoltage Control.—Motors are sometimes controlled by varying the supply voltage to the armature. Two-voltage controllers are quite common and three voltages are sometimes used in practice. Controllers have also been built with a larger number, but these are not practical because of the fact that more than one or two voltages are not usually available except in laboratories. Where multivoltage control is employed the motor field is usually connected permanently across one voltage and only the voltage across the armature varied. With this method of control the speed of the motor is almost directly proportional to the voltage supplied to the armature.

The principal argument in favor of the multivoltage control is that it is possible to get efficient low speeds. This type of control is often combined with armature-resistance and field-resistance control to get wide speed ranges. For instance, take the case of a motor operating on a 115/230-volt circuit. If armature resistance is provided to get 50% speed reduction on 115 volts this latter speed will be only one-fourth of the normal speed at 230 volts. If, in addition, speed increase by shunt field control of 2 to 1 is provided, the total range in speed will be 8 to 1.

Control by Shifting the Armature.—Another method of obtaining speed control is by shifting the motor armature. This does not require a separate controller, but a handwheel, by which the position of the armature can be adjusted is mounted directly on the motor as shown in Fig.

17. The armature and field poles are tapered slightly, so that changing the position of the armature changes the air gap. To increase the speed the armature is shifted so that the air gap is increased and the flux decreased. The motor must, therefore, increase in speed in order to generate the necessary counter e.m.f.

Control by Adjustable Poles.—There is another method of obtaining speed control by varying the magnetic circuit. In this case the field poles are made hollow and the speed is adjusted by varying the position of iron plungers which are placed in the poles.

Speed Regulation by Armature Shunting.—It has been pointed out that wide variations in speed are obtained for different loads when the speed of a motor is regulated by resistance in series with the armature. It is often necessary on installations such as skip hoists and elevators

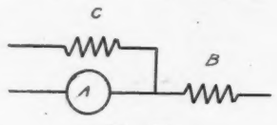


Fig. 18.

Across-the-line diagram showing connections for placing resistance against the armature terminals in addition to starting resistance in series with the armature, to obtain wider variations in speed for different loads.

to obtain a slow down speed which is fairly constant for all loads, so that reliable stops can be made. The usual method of accomplishing this result is to place a resistance across the armature terminals in addition to inserting the starting resistance in series with the armature. Fig. 18 is an across-the-line sketch of the connections.

Assume that the motor is shunt wound, that the resistance B is 2 ohms, the full-load motor current 70 amperes, and the line pressure 230 volts. If no armature shunt resistance is used, the drop across series resistance B is 140 volts at full load and 10 volts at 5-ampere load. The voltage across the armature is approximately 90 volts at full load, and 220 volts at 5-ampere load.

Assume now that the armature shunt resistance is 2 ohms. The armature voltage (which is roughly a measure of the speed) for any load can be calculated simply by writing an equation of the voltages of the circuit.

The current in the shunt C is equal to the armature voltage, E_a, divided by the resistance of the shunt, or $E_a/2$. Both the current in the shunt, which is $E_a/2$, and the current in the armature, which is designated I, pass through the series resistance. The drop across the series resistance is therefore $\left(\frac{E_a}{2}+I\right)2$. The drop across the armature is E_a.

$$\text{Therefore } E_a+\left(\frac{E_a}{2}+I\right)2=230$$

$$\text{and} \qquad E_a+I=115.$$

$$\text{If } I \text{ is 70 amperes} \qquad E_a=45, \text{ and}$$

$$\text{If } I \text{ is 5 amperes} \qquad E_a=110.$$

It is therefore apparent that with only series resistance practically no speed reduction will be obtained at light loads, while with an armature shunt of ohmic value equal to the series resistance at least 50% speed reduction is obtained even at no load. It is, of course, possible to obtain different speeds by varying the value of either the series or shunt resistance.

With a series- or compound-wound motor the effect of the armature shunt is even more pronounced because both the armature and armature-shunt current pass through the series field, thus giving a heavy field current which tends to hold down the speed.

(To Be Continued.)

RADIUM AS AN ELEMENT IN THE SAFETY MOVEMENT.

Used to Illuminate Exposed Electric Switches, Thereby Indicating Danger.

Radium is best known to the world through its curative properties in the treatment of cancer, and through its commercial value in making radium-luminous material. The power of radium was made known only a few years ago through the efforts of a Polish woman scientist, and a French and an American professor. Radium now treats thousands of cases of cancer annually, preventing death and eliminating a great deal of suffering. Radium's role in industry as a life saver is less spectacular, but perhaps even more important than it is as a therapeutic agent. The great mass of accidents in factories, in mines and in other industrial institutions where darkness is an agency of danger, are being eliminated through the newest invention of science—radium luminous material. Radium-illuminated watches are already familiar articles. The same material that illuminates these watch dials is now being employed in great factories on power-line switches where fumbling might mean serious danger to the operator.

High-pressure gauges, which are installed as an insurance against dangers, are deprived of a great deal of their safety value through inconstant lighting. Their dependability as indicators is increased tremendously through making them safe 24 hours a day by the application of radium luminous material, which is invariably luminous in the dark. Steam gauges and water gauges of all sorts are being provided with radium illumination to increase safety.

Electric switches are often set in places which are unlighted. This includes switches for electric-lighting equipment which are usually visible only after the light they control has been turned on. A spot of radium-luminous material on the switches makes them easily located in the dark, so that in emergency they may quickly be made use of. When other lights fail, fuses blow out, or wires break down radium will glow dependably without danger of explosion or of burning.

ELECTRICAL FRATERNITY CHAPTER FORMED IN CLEVELAND.

Alumni members of Eta Kappa Nu, the undergraduate electrical fraternity, residing in Cleveland and vicinity recently completed the organization of an alumni chapter in that city. H. S. Green was elected president; D. N. Hanchette, vice-president, and R. E. Mausk, secretary-treasurer.

Lighting Opportunities Open to Contractor-Dealers

Industrial Situation Such That Better Lighting Is Necessary to Bring Labor Efficiency and Production to Profitable Point—Some Facts and Figures That Should Convince the Skeptical

There has probably never been a time when the opportunities for making new lighting installations are greater than they are at present. The high cost of labor and the difficulty of getting and keeping it is making manufacturers keener to obtain more production from employes. If there is a lighting installation in any plant that cannot be improved so that greater production will result no one has yet been able to point it out.

Industrial lighting has not yet reached the degree of perfection where more or better light is not desirable, and in these days of comparatively low cost of lighting and high cost of labor, better lighting is exceedingly profitable. This means that every industrial user of light is a good prospect for a new lighting installation. All that is necessary is to show him what improvements can be made and why these improvements will prove profitable to him.

At the present time it is a case of balancing the cost of lighting with the other costs of manufacturing. A manufacturer must pay the interest and depreciation on his plant and machinery regardless of the production he gets out of them. He must pay for power. He must pay for labor and he must meet all other operating and overhead expenses. If the cost of all these go up he can afford to pay more for a little increase in efficiency than he could if all the costs remained the same or tended downward.

If lighting increases efficiency of operation and if it increases production he can afford to increase his lighting bill until the gain is offset by the increased cost of lighting. This point is determined by the other costs of manufacture.

Ratio of Increased Production to Cost of Better Lighting.

Suppose, for example, that a man is paid $10 a day to operate a machine which costs $5 a day in fixed costs and all operating costs, aside from labor, to operate. Let us assume that the present output is 100 units, or a cost per unit of $15 divided by 100, or 15 cents. Now it is found that by spending 20 cents more a day to light this machine 10 more units can be turned out without increasing any of the other costs to an appreciable extent. Then the cost per unit becomes $15.20 divided by 110, or 13.8 cents. We add 20 cents more of light and find that we have increased the output to 115, all other cost not being appreciably increased. The unit cost of operating this machine now becomes $15.40 divided by 115, or 13.4 cents. It has paid so well thus far to spend more money for better lighting that 20 cents more a day for light is added, with the result that the production is increased to 117 units per day. This makes the unit cost $15.60 divided by 117, or 13.33 cents per unit. Another increase of 20 cents a day of light is made and the production climbs up to 118 units, with a cost per unit of $15.80 divided by 118, or 13.3 cents. Although the gain this time has been small we try another 20 cents' worth of light a day and get an additional unit of production. This makes the unit cost $16 divided by 119, or 13.4 cents per unit. The last 20 cents of light has increased the cost of production nearly half a cent over the 80-cent increase. It is evident, therefore, that the most economical results can be secured by adding only 80 cents' worth of light a day even though a further addition would still increase production.

If the cost of labor and fixed and operating costs of the machine itself were lower the balance would have been struck sooner, and if they were higher the balance would have been struck later. It would have been profitable to have added more than a dollar a day to the cost of light if the cost of labor and of the machine were high enough.

This illustrates why the manufacturer will find it to his advantage to increase the amount of light he is using even though only a few years ago he had the most economical and efficient installation that could be made and a perfect balance had been struck between the cost of production and the cost of lighting. Since then the cost of his labor has gone up, machinery costs him more, his buildings cost more and his power and all other costs are higher. For this reason it will pay him to increase his lighting costs in order to increase his production up to the point where lighting costs and production costs again balance.

Of course, in actual practice the figuring of this balance is not as simple a matter as the illustrative example might indicate. In nearly every case the increased production due to lighting will increase certain other costs. The machine will consume more power, the cost of labor even may be increased, the depreciation, wear and tear, etc., on the machine may amount to more. Therefore, in order to strike the right balance, it will be necessary to figure all costs of each increase in lighting.

Opportunities for Better Lighting in Stores and Offices.

It is to the advantage of the manufacturer and the electrical contractors, as well as to the advantage of everyone else who is interested in the selling or the using of light, to have the "before-and-after" costs of production carefully figured every time a change is made in the lighting installation. If more of this had been done in the past there would be a great deal more light sold today than there is. There would be more work

for contractors in making lighting installations and in changing them, and the conditions under which men and women work would be better and healthier.

Much that has been said in regard to the factory applies with equal force to the office. Very few offices are lighted as well as they should be. Though salaries have not advanced to the same extent that wages have, it will soon be necessary to advance them or so many people will be working for wages that it will not be possible to find enough to work for salaries. Therefore, an office that a couple of years ago had its cost of lighting and other costs very nicely balanced will find it worth while to increase the cost of lighting sufficiently to strike a new balance.

The merchant is in very much the same condition as everyone else. His rent has gone up, the cost of advertising has gone up, the cost of labor has gone up. The chances are that in all cases he is not able to realize a large enough margin of profit on all that he sells to make up for this difference. The only thing that he uses as a medium for selling goods that has not gone up to any very appreciable extent is lighting. Consequently he is turning more and more to lighting as a help in selling goods.

In window lighting we find a greater use for spotlights, colored lights and other paraphernalia which has been found so effective in the past in attracting and directing attention on the stage. The modern show window cannot be said to be really complete unless it is equipped for the use of color screens and a spotlight. This lighting equipment means that the sales power of the windows is increased far beyond the cost of providing and using it. Accordingly it will be used more and more as time goes on.

More and better light in the store is being found a great advantage. There are some stores that have found the effect of good lighting on the employes is worth more than it costs. One druggist stated that he had found it paid to install the kind of lighting that had the most soothing effect upon the nerves. He said that his employes had to work for long hours under these lights and if in any way the lighting system proved irritating to the eyes or the nerves, if it was not harmonious and soft while at the same time giving plenty of light, his employes became ill-tempered, answered the customers curtly and drove away far more trade than it would cost to light the store properly. On the other hand, he found the right kind of lighting, that which is pleasing to the eyes and the artistic feelings of the clerks, had the effect of making the clerks much more agreeable, enabled them to work hard all day without feeling undue fatigue. This resulted in their making a great many sales that otherwise would not have been made, caused customers to enjoy trading at the store and in every way proved exceedingly profitable.

Today there are real dollars and cents reasons why every light user, especially commercial and industrial light users, should use more light and use it in a better manner. This means there is an immense amount of work that should be done on lighting installations, that there is a tremendous field for the cultivation of the sale of fixtures and lamps.

As a matter of fact there is the farmer field, that has not yet been more than scratched. In addition to the ordinary indoor and outdoor lighting there is a field for outdoor lighting by the farmer. There will soon be great opportunities for development of farm lighting.

To make all installations entirely satisfactory, however, it is well to encourage the user of lighting to figure out for himself the dollar-and-cent value of the new installation. This will not only make him satisfied with his new installation but will teach him the value of good lighting in a way which will cause him to improve his lighting installation more frequently than would otherwise be the case.

CIVIL SERVICE EXAMINATION FOR POWER-HOUSE ENGINEER.

An open competitive examination for power-house engineer has been announced by the United States Civil Service Commission, applications to close Jan. 4. A vacancy at the United States Military Academy, West Point, N. Y., at $1200 a year, and vacancies in positions requiring similar qualifications at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. Competitors will not be required to report for examination at any place, but will be rated on their physical ability, training and experience. The duties of this position will be to take charge of the plant, consisting of 3000 hp. in boilers and 1500 kw. in generators. Those desiring to make application should write to the Civil Service Commission, Washington, D. C., asking for form 1800 and mentioning the title of the examination desired.

ELECTRIC METERS CONSIDERED AT SECTION MEETING.

The electric meter section of the Empire State Gas and Electric Association held a meeting Dec. 8 in Buffalo, N. Y., the program consisting of addresses by Perry A. Borden, assistant laboratory engineer of the Hydroelectric Power Commission of Ontario, on "Measurement of Maximum Demand"; B. W. St. Claire, of the standardized laboratories, General Electric Co., on "Testing Methods and Instruments," and a paper on "Factory Methods of Tests and Inspection," by V. H. Todd, of the Newark works, Westinghouse Electric & Manufacturing Co.

WESTERN ELECTRIC OFFERS BONDS TO EMPLOYES.

The board of directors of the Western Electric Co. has approved an extension of the plan whereby the 22,000 employes of the company are given an opportunity to be among the holders of Western Electric five-year, 7% convertible gold bonds. Instead of limiting its investment arrangements to its older employes as has been the custom in the past, the company is encouraging those who have six months or more continuous service by Dec. 1 to acquire their quota of the securities. The sale to the employes is on an installment basis.

Developments in Practice and Art of Telephotography

Advancement in Science of Photography and Telegraphy Combined to Perfect Transmission of Photographs—Early Inventions Improved and Applied to Modern Conditions — Television to Be Next Step

By NIKOLA TESLA

The recent successful experiments by Edouard Belin of Paris in the transmission of photographs between New York City and St. Louis, a distance of 1000 miles, have naturally aroused new interest in this rather old art. Mr. Belin's apparatus has been examined with a knowledge of previous efforts in that direction, and it must be admitted that the French inventor has achieved a marked improvement. It is true that his apparatus in many of its features is old and well known, but all the details have been worked out skilfully and his photographic reproductions are not only good likenesses of the originals but are expressive in no small degree. In common with other arts the transmission of pictures to a distance has been brought to its present state of perfection by slow and gradual improvements effected in the course of 77 years. The literature on the subject is quite voluminous and difficult to peruse, as the articles are published in various languages and scattered through numerous periodicals. Only one complete and exhaustive work has been published in German by Dr. Arthur Korn of Munich and Dr. Bruno Glatzel.

First Patents Taken Out Many Years Ago.

The original idea is due to Alexander Bain, a Scotch mechanician, who secured a British patent disclosing the invention in 1843. His plan contemplated the transmission of printed letters, drawings and pictures in the following way: At the sending station a holder with insulated metal points was arranged to glide in the direction of the lines over a frame resting on the printed page to be reproduced at a distance. Within this frame, and at right angles to its plane, a number of short wires were imbedded in sealing wax, their lower ends being in contact with the letters which in turn were all electrically connected. As the holder moved back and forth the insulated metal points would be brought in and out of contact with the upper ends of the short wires, thus controlling the flow of the current through them. Each metal point was joined by a special line to the receiving station where there was a similar holder made to slide over chemically prepared paper laid on a grounded metal plate. When a battery at the transmitting end was connected with one of its poles to the letters and the other to the ground the current impulses traversing the line wires and the chemical paper would cause changes of color in the latter, thus reproducing the characters. A great number of points and line wires were required to attain satisfactory results and, realizing this objection, Bain proposed to avail himself of only one wire, but did not give full information in this regard. Subsequently Bonnelli and other inventors made improvements in his apparatus, reducing the number of the wires to a few. There is no doubt that, despite the manifest crudity of this system, it was quite capable of being used commercially in the transmission of type as well as drawings and pictures and may yet be found valuable.

The first practical success was achieved by an Englishman, Frederick Collier Bakewell, who secured a British patent in 1847 on a process, some features of which have proved to be indispensable in later years. He employed as a transmitter a cylinder on which the characters were written with insulating ink. A metal point bore on the cylinder and advanced slightly with each revolution of the same exactly as in the older form of phonograph. A similar cylinder covered with chemical paper and equipped with a sliding point was provided at the receiving station. The cylinders being grounded and a battery included in the line wire connecting the transmitting and receiving points, the passage of the current resulted in a discoloration of the paper and reproduction of the written characters at the receiving end. Considering the period Bakewell's apparatus was surprisingly perfect, particularly in the feature of maintaining the rotating cylinders in synchronism for which purpose he provided an automatic as well as a hand correction. A controversy was waged between Bakewell and Bain for the honor of priority, but in this respect there can be no mistake. Bain was the originator of the idea, while Bakewell was the first to carry it out successfully.

Use of Chemical Paper Considered Impractical.

The use of chemical paper was considered objectionable, and in 1851 Hipp eliminated it, producing the impressions at the receiver with a magnet actuated by the transmitted impulses. It is curious, though, to observe that the modern art depends entirely on this very device. In 1855 Casselli modified the Bakewell apparatus by employing carefully synchronized pendulums at the transmitting and receiving stations, thus replacing the rotary motion by a to-and-fro movement as in the Bain arrangement. Casselli seems to have had more enterprise than his predecessors, and the apparatus which he perfected in 1860 was actually used with some success for a short time in service between Paris and several other cities in France. Its abandonment was probably due to

the slowness of transmission and lack of demand for this kind of facility. It is singular that many treatises on physics and other text books mention Casselli while ignoring Bain and Bakewell.

Shortly after this Meyer perfected a system which was used with success in France, and may be fairly considered as the first thoroughly practical application of ideas in this field. A curious improvement was made by Gérard who, in 1865, proposed the use of flat disks in place of the cylinders of Bakewell. Ever since one wire was adopted for the transmission it became an imperative necessity to maintain perfect synchronism between the transmitter and receiver, and many inventors devoted their energy to this task. D'Arlincourt resorted to tuning forks, and his idea was subsequently carried out in a more perfect manner by Lacour. At about this time the invention reached America, and in 1870 Sawyer brought his ingenuity to bear on the evolution of a process in which he employed zinc clichés. These were very reliable and constituted a signal advance.

In 1880 Edison devised an apparatus on the principle of that used by Sawyer, except that the impressions were produced on paper in bas-relief. This idea was carried further by Dennison in instruments of the reciprocating type. Through the introduction of the Tesla alternating system of power transmission a novel means was afforded for operating transmitters and receivers. The use of synchronous motors was proposed first in 1893 by Sheehy.

Developments Permit Use of Photographic Films.

In all cases without exception it was necessary to provide an actual print, drawing or sketch to be transmitted until Lenoir introduced photographic films into the art, making possible the transmission of any kind of picture. This was a great step forward, but the honor of the first practical success belongs to an American engineer, N. Amstutz, who used photographic sending clichés in relief for the first time and with complete success. Amstutz was a true pioneer, and his improvement is essential in the carrying out of the modern processes. It is true that as early as 1865 a Frenchman, Hubert, had suggested the use of letters written with thick ink, but this was of little value, and Amstutz was undoubtedly the first to produce and use the clichés on which the up-to-date art vitally depends. Perfectly satisfactory demonstrations were made with his devices in this country more than 20 years ago, when pictures were transmitted over telegraph wires to great distances. Samples of his work have been preserved which clearly show how much he was ahead of his time.

Following Amstutz, Dunlany, Palmer, Mills and other American inventors took up picture transmission with more or less success. By this time the necessity presented itself for increasing the rapidity of the process by greater speed of the devices as well as multiplex transmission. The Belgian inventor, Carbonelle, made an important improvement in this direction when he introduced the telephone diaphragm carrying a stylus for making the impressions.

Of all inventors, however, Dr. Korn was the most successful as well as prolific in the suggestion of improvements, his photographic method of recording carried out in 1903 being the most significant. The general idea of photographic recording had been already advanced by George Little, and a few years later Dillon took out a patent involving the use of sensitized paper and a mirror reflecting a beam of light on the same. But it is obvious that at that time it would have been hardly practicable to use this suggestion, as photography was not sufficiently advanced. In illustration of this it may be mentioned that in 1892 the attention of the scientific world was directed to a wonderfully sensitive receiver, consisting of an electron stream maintained in a delicately balanced condition in a vacuum bulb, by means of which it was proposed to use photography in the transmission of telegraphic and telephonic messages through the Atlantic cables, and later also by wireless. This proposal was met by unsurmountable objections to the photographic method. Indeed, the Belin process has been rendered possible largely through the great improvements in the sensitive films which have been evolved in response to the urgent demands of the motion picture and also under the stimulus of the recent war.

Selenium Cell and Vacuum Tube Used to Transmit and Receive.

In the apparatus invented by Dr. Korn a selenium cell is used at the transmitter to vary the intensity of the sending current, and at the receiving station he employs a vacuum tube of high intensity which throws its light through a fine slot on a sensitive plate. The tube is excited by high-frequency currents supplied from a Tesla transformer and may be flashed up many thousand times per second. The motion of the receiver element is effected either by a wire galvanometer, oscillograph or telephone diaphragm. The Korn system has been used for some years past with success in Germany and other countries. In fact, it has been operated for some time even by wireless. Patents on this mode of transmission have been granted in 1898 and 1899 to Küster and G. Williams, but the arrangements involved the employment of Hertz waves and were impracticable. Later Frederick Braun, Pansa and Knudsen secured patents which, however, are equally defective. Success in this direction has been achieved so far only by Korn, Berjonneau and T. Baker. Invariably the inventors employ a wire galvanometer which is especially suitable for great speed. Telautographic transmission by similar means through wires as well as wireless is now common and is effected by employing a transmitter of two components, the original idea of which is due to an Englishman, Jones, who made that suggestion as early as 1855.

Present Developments Involve Many Old Principles.

To this short story of picture transmission Belin has contributed the latest chapter. The process he has finally adopted after many years of persistent effort involves the use of two cylinders rotating in synchronism—one for transmitting and the other for reproducing. The former is of copper and is prepared for operation by

having its surface coated with a thin shellac solution, wrapping a carbon print of the photograph about it with its face to the cylinder and immersing the whole in hot water, this causing the gelatine to adhere to the cylinder surface in proportion to the degree of blackness so that a likeness of the print in bas-relief is obtained. On this cylinder bears the stylus of a microphone diaphragm which is slowly moved forward by the revolution of the cylinder as in a phonograph.

Edouard Belin and His Device for Transmission of Photographs.

In this manner the pressure of the carbon contacts is varied in conformity with the changes of the surface, and the microphone currents pass over the transmitting wire to the receiving station where they cause corresponding deflections of a mirror forming part of a highly sensitive deadbeat oscillograph. A strong beam of light reflected from the mirror traverses a screen graduated from full transparency to opacity and is led through a microscopic opening to the sensitive film wrapped around the receiving cylinder. Special provisions are made to keep the cylinders exactly in step as this is indispensable to good performance. The film is, of course, protected against the external light, and when the operation is completed it is developed as usual so that either a positive or negative print is obtained according to the position of the screen. There is nothing in his apparatus which is fundamentally novel; in fact, every feature of the same has been disclosed in the prior art. Even the graduated screen, which is one of the most essential parts, has been employed before by Dr. Korn. But Mr. Belin has displayed considerable ingenuity and skill in all the details, and his reproduced photographs are most excellent. There is every reason to believe that his efforts will be rewarded by an extensive practical application of his devices.

Television to Be Next Step in Progress of Transmission.

The transmission of photographs constitutes only the first step towards the immeasurably greater achievement of television. By this is meant instantaneous transmission of visual impressions to any distance by wire or wireless. It is a subject to which I have devoted more than 25 years of close study. Two of the impediments which years ago seemed unsurmountable have been successfully overcome, but great difficulties are still in the way. These are encountered in the inertia of the sensitive cells and the enormous speed required to make possible the vision of persons, objects or scenes as in life. It is the problem of constructing a transmitter analogous to the lens and retina of the eye, providing a medium of conveyance corresponding to the optic nerve, and a receiver organized similarly to the brain. It is a gigantic task, but I am confident that the world will witness its actual accomplishment in the near future.

INSTALLATION OF LIGHTING UNIT SELLS 66 MORE.

That one successful way to sell lighting units is to install one unit in an establishment where a number of others could be installed to advantage, has been demonstrated by F. A. C. Tocque, of the Burdorf Co., Louisville, Ky. At his first call upon a company which operates three stores and offices Mr. Tocque succeeded in securing the trial sale of a 500-watt "Denzar" unit for installation in the new directors' room. After the new unit had been in place for a few days Mr. Tocque called and induced the company to let him install 26 "Denzars" of 200-watt capacity in one of the three stores. After the installation had been in use for a week Mr. Tocque was invited to make an installation of 40 more units in the two remaining stores. He considers the one unit he first installed in the directors' room as the sales maker for the other 66 units.

COST ANALYSIS OF MANUFACTURE OF LIGHTING FIXTURES.

Detailed Study Shows Costs to Depend Upon Various Conditions That Cannot Be Covered by an Estimated Percentage.

There is scarcely anything more vital to the fixture manufacturer than a correct knowledge of the cost to manufacture each individual part or complete fixture sold. Unfortunately, however, there is at present no standard method of computing these costs. The accompanying chart has been prepared by a member of the National Council of Lighting Fixture Manufacturers to serve as a basis of cost analysis, and brings out prominently the many items which make up the final fair selling price of any individual product.

TABLE SHOWING TYPICAL OLD-STYLE METHOD OF ESTIMATING FIXTURE COSTS.

Item	Cost
Canopy	$0.12
Crowfoot	0.03
Nipple	0.04
Casing	0.06
Chain, per yd.	0.08
Two loops	0.10
Body	0.35
Four arms	0.80
Bottom knob	0.10
Finishing	0.45
Total	$2.13

There are undoubtedly many successful businesses which could be made still more successful by a careful study of manufacturing costs. It is not improbable that some fixture manufac-

turers may be selling certain lines at prices which do not bear their fair share of overhead and selling expense. This means that they are not only losing money for the maker himself, but they are forcing some other manufacturers of a similar line to cut his prices to the same unfair figure or else lose his share of the available business. The time-honored method of taking the average cost of material and the average labor cost, dividing this among the number of fixtures produced, and then adding more or less of an "educated guess" as the percentage of overhead and expense seldom if ever gives the true result. This is especially true of a trade which deals with so many different types of products and such widely differing raw materials as the lighting-fixture industry.

The weakness of the old methods of figuring are evident when the actual costs are split up into the various elements indicated. Direct costs, general overhead, and selling expense each depend upon a somewhat different set of conditions and vary with these conditions rather than with each other. Overhead expense varies with the size of the plant and its possible output, direct costs are roughly in proportion to the actual output, sales expense varies with output and the saturation of the market, and indirect labor charges and other items of cost may have no relation to output at all. A typical old-style method of computing fixture costs is shown in the accompanying table. It is evident from a brief study of this table and the larger chart that the old method is subject to many chances of error.

GRAPHIC PRESENTATION OF A DETAILED ANALYSIS OF SELLING COSTS AND THEIR RELATIONS TO THE SELLING PRICE

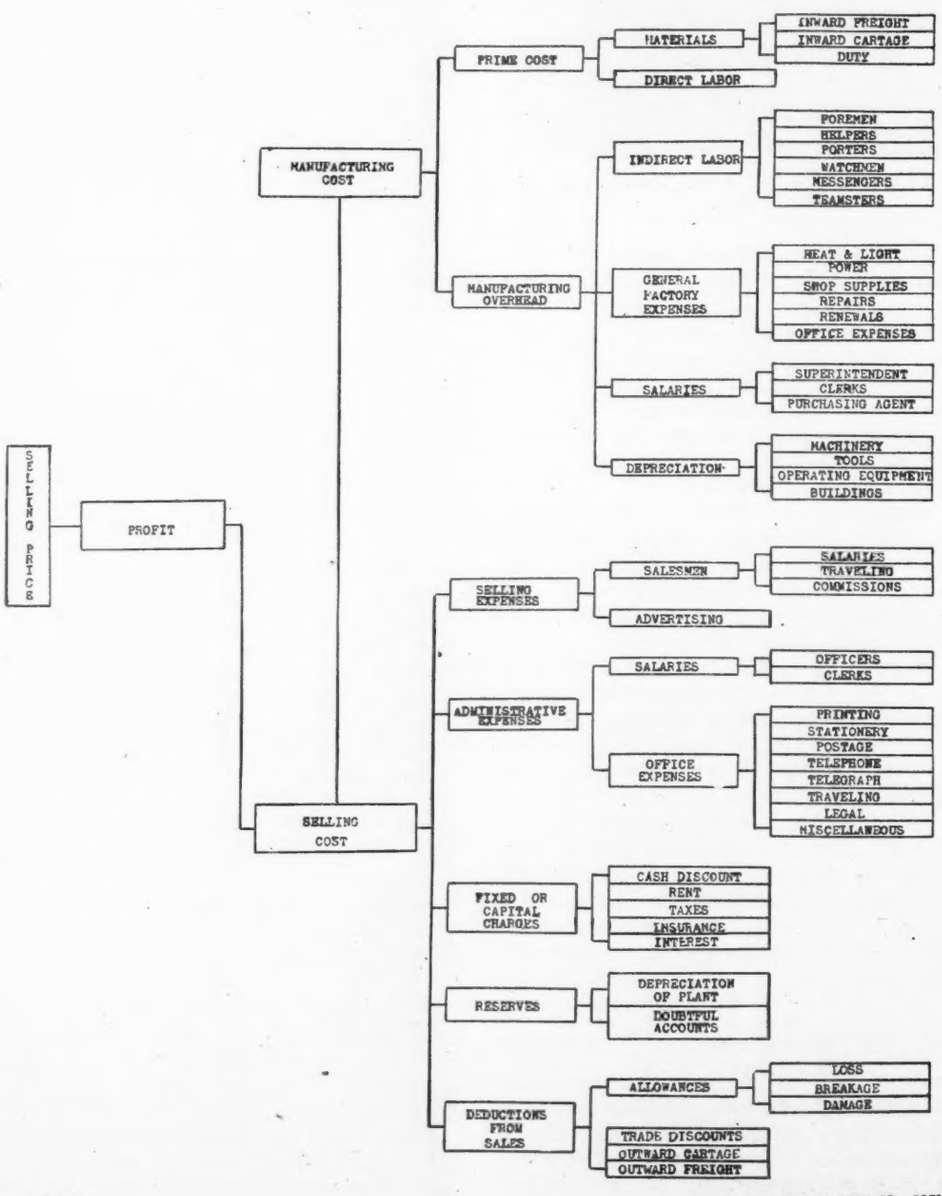


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CHART PREPARED BY RICHARD APPEL

Items of Fixture Manufacturing Costs and Selling Price. Chart Showing Various Details Comprising Different Major

EDITORIAL COMMENT

Electricity in the Iron and Steel Industry

The iron and steel industry is by far the largest single consumer of electrical energy; and yet the field is by no means saturated. A vast amount of hydraulic and steam power is used where electricity as the working medium would eliminate many troubles, save money, and increase the output. Only the initial expense of making the change stands in the way of electrification.

Few realize the enormous power demands made by the iron and steel industry, and to what a relatively small extent the central-station companies have entered this desirable field of heavy power consumption and high load-factor. Altogether there is about 900,000 kw. in generating capacity devoted to this industry. This is made up of some 500 motor equipments for driving main rolls and involving something like 850,000 hp. in motors. There is a further connected load of approximately 1,350,000 hp. for auxiliary drives of almost endless variations.

To the motor load of about 2,200,000 hp. there should be added the electric furnace load, which is estimated as representing 250,000 kw. in generating capacity, the whole requiring about 900,000 kw. of generating capacity to supply it. As the electric furnace is finding somewhat greater application in foundries than in steel mills, there is, perhaps, a greater opportunity for central-station companies to take on this form of load than is the case with the motor load of the steel mills. The mills, with the large quantities of blast-furnace gas available, are able to produce a considerable amount of power as a by-product. On the other hand, the foundries do not as a rule produce power, but buy it from public utilities, so that the electric furnace and the foundry make an admirable working combination from the viewpoint of the central-station company. Moreover, the foundries are more widely scattered than the steel mills.

At the present time when the steel mills and even the foundries are feeling the effects of curtailed buying, the central-station companies should find the present most opportune to take up such matters as reserve capacity, emergency stand-by service and the interchange of power when either has an excess over requirements. These are matters that might well be settled now, before the hum of industry gets going again.

The central stations and the steel mills have many problems in common, such as fuel supplies, stocks and sources, power production, and distribution and the co-ordination of load and power produced. The common interests of each would call for close working harmony. It would seem that now is a particularly good time for getting together.

Adapting Modern Inventions to Electric Service

The recent announcement by the Department of Agriculture that the wireless telegraph will be used for delivering messages to farmers regarding such matters as market prices for agricultural products, approaching storms, current events, etc., is but another instance where wireless is introduced into everyday life.

Wireless telephony has been in use to a limited extent by central-station and transmission companies for several years. By using wireless instead of depending upon wires, communication can be carried on regardless of such things as floods, wind-swept lines, and similar interruptions, which, at once, necessitate communication and at the same time so often make it impossible. Not only transmission companies with very long lines traversing difficult terraine but utility companies with lines less than 60 miles in length and traversing settled communities are using the wireless telephone because of its immunity from extraneous influences.

Wireless telephone receivers are being employed for locating deteriorating insulators upon wooden transmission lines, and wireless transmitting sets are used for enabling the patrolmen to keep in touch with the generating station miles away. Aeroplanes have been used for patrolling lines and for rapidly transporting a line gang to the scene of operations.

When the 220,000-volt transmission lines of 1000 miles and more become common practice, we may see both wireless telephony and the aeroplane come in for more recognition. The central station is noted for its rapid growth; it is one of the youngest industries, yet one of the most vital. It deals with a power that has a speed approaching that of light, namely, about 186,000 miles per second. Is it any wonder, then, that the wireless telephone and the aeroplane should be employed in keeping this speedy medium the servant of man?

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

ILLINOIS UTILITY ASSOCIATIONS TO HOLD JOINT MEETING.

Public relationship will be among the important subjects discussed at the joint meeting of the Illinois Electric Railways Association, Illinois State Electric Association and the Illinois Gas Association to be held at the Sherman House, Chicago, March 15-17. There will be a joint business session on the morning of the first day and in the afternoon the three sections will hold technical sessions. Practically the same program has been arranged for the second day, with the annual banquet in the evening. The morning of the third day will be devoted to a general discussion of the various problems of public relationship. It is expected that banking authorities will give addresses at the sessions set apart for the discussion of finance, regulation and similar subjects.

COAL COST COMPELS UTILITY TO READJUST RATE SCHEDULE.

Customers of New York Edison Co. Notified of Adjustment Charge on Bills Based on Increased Cost of Coal.

The New York Edison Co. has notified its customers that effective Dec. 1 an adjustment charge will appear on its bills to partly offset the present abnormal cost of coal. This adjustment is in accordance with the company's schedules relating to rates and service conditions on file with the Public Service Commission for the First New York District, and is made on the principle of the "sliding scale," rising or falling with any increase or decrease in the cost of coal. The customers are advised that the adjustment charge will disappear if and when this cost returns to the basis upon which the existing rate schedules were established. The announcement further states:

"When these schedules were adopted we were most apprehensive of future conditions and the right was then reserved, as is shown by the records of the Public Service Commission, to increase our rates by $0.01 a kw-hr. should conditions justify. Notwithstanding the constantly rising cost of coal, labor and supplies, with which all are familiar, we hoped to get through the entire war and readjustment period without making any change in our schedules. This would have been accomplished as planned, probably, were it not for the abnormal increase in the cost of coal which has now reached a point where it can be carried no longer without jeopardizing seriously the financial position of the company.

"The adjustment for low-tension service is $0.00050 a kw-hr. for each increase or decrease of 10% above or below the average cost of coal of $3 a ton in 1916, when the present rate schedules were adopted. The actual increase in the cost of coal in each of the 10% steps during the past three years has been slightly in excess of $0.00057 for each kilowatt-hour; hence we shall continue to bear part of the increased cost of coal over the prevailing averages of 1916, and, in addition, the entire added cost of labor, material, supplies and taxes. We shall endeavor to carry these elements of additional cost throughout the present period of readjustment, trusting that it may not be necessary to ask the Public Service Commission for any further modification of our schedules through which the cost of the service would be increased.

"Under an order from the Public Service Commission for the First District, the exact cost of coal is reported from month to month and this adjustment is covered by a monthly rider which is on file at the offices of the Public Service Commission, as well as all of the offices of this company, where it may be consulted at any time. Upon request we shall be glad to furnish any further information desired concerning this adjustment.

"It will be apparent that under the 'sliding scale' principle upon which this adjustment is based, any reduction in the cost of coal will immediately accrue to the benefit of the consumer. This company is of course in no way responsible for any of these increases in the cost of service. On the contrary they have been largely, if not entirely, the result of the war and post-war conditions and many were either approved or actually established by the federal government at Washington as a necessary feature of our part in the great war effort.

"In applying the added coal cost to each kilowatt-hour of the entire service of the company the result is spread over a very wide area. It is small as related to the kilowatt-hour and is practicably negligible to a very large percentage of our customers. However small the amount we greatly regret that any necessity to modify our schedule should have arisen and trust that with the anticipated early returns to normal conditions this element of adjustment may speedily disappear."

In submitting the revised coal-riders to the New York Public Service Commission the Edison company states: "It is understood that as these riders are filed in accordance with the reservation of the company when the existing maximum rate of $0.07 a kw-hr. was adopted, to return to a maximum of $0.08, if justified by the conditions of cost, the company will not permit the increase in the cost of coal to produce a corresponding increase in the cost of electric current beyond $0.01 a kw-hr. without first going to the commission and reporting to you any conditions which might cause a cost beyond that figure. Thus, though the company has no guarantee that the increased cost of coal will not exceed $0.01 a kw-hr., the company guarantees that under the riders here filed the increased cost to the consumer shall not exceed $0.01 a kw-hr. without first reporting the matter to you for such action as you may deem justifiable."

BUSINESS MEN TO VOTE ON TRACTION PROPOSITIONS.

The Chamber of Commerce of the United States, composed of business men's associations throughout the country, has submitted a set of traction propositions to its members for a referendum vote. These are conclusions reached by a committee after a careful study of the problem of urban and interurban electric railway transportation. In public ownership and operation

the committee finds no solution of present-day problems, believing that public opinion is overwhelmingly opposed to it and that in most instances legal difficulties would prevent the application of that alleged remedy in the very near future.

Other recommendations are: Existing traction facilities should be conserved and the attitude now taken toward problems should be based upon present and future needs of the community; protection should be made against unfair competition; intelligent regulation by competent official bodies should prevail; all taxation burdens unrelated to service of the railways should be removed. The committee declares that some means must be found of giving the electric railways financial credit, as adequate service is possible only through the lines being able to provide the facilities that the public interest requires for its convenience.

POWER-FACTOR CONFERENCE HELD AT PHILADELPHIA.

Central-Station Representatives Discuss Paper Presented Before Association of Edison Illuminating Companies.

A conference on power-factor problems was held Nov. 22 in Philadelphia, the meeting being called by Walter H. Johnson, president of the Association of Edison Illuminating Companies, at the request of a number of leading men in the central-station industry. The first part of the program contained abstracts of the discussion by L. L. Elden and A. S. Knight, Edison Electric Illuminating Co. of Boston; Philip Torchio, New York Edison Co., and George P. Roux, Philadelphia Electric Co., of the paper on "Commercial Aspects of Power-Factor, Its Measurement and Correction," presented by Charles J. Russell, general commercial manager of the Philadelphia Electric Co., at the recent convention of the Edison Association in New London, Conn. This was followed by the reading of new written discussion by L. E. Sinclair, Potomac Electric Power Co., Washington, D. C.; R. H. Tillman, Consolidated Gas, Electric Light & Power Co., of Baltimore; Robert Lindsay, Cleveland Electric Illuminating Co.; G. W. Van Derzee, Milwaukee Electric Railway & Light Co.; Henry H. Lyon, Buffalo General Electric Co.; N. L. Pollard, Public Service Electric Co. of New Jersey, Newark; Charles S. Dawson, Scranton (Pa.) Electric Co.; B. F. Cleaves and W. H. Wade, Penn Central Light & Power Co., Altoona, Pa.; C. W. DeForest, Union Gas & Electric Co., Cincinnati; E. W. Babcock, T. I. Jones and S. D. Sprong, Brooklyn Edison Co.; W. B. Gear, Commonwealth Edison Co., Chicago, and H. W. Eales, Union Electric Light & Power Co., St. Louis.

Mr. Russell, who had received the written discussion in advance and collected the various points covered, replied to the questions raised. Some of the important aspects of the power-factor situation as it affected revenue and station capacity were discussed informally by F. S. Dellenbaugh, Jr., of the Massachusetts Institute of Technology. Dr. C. P. Steinmetz, General Electric Co., Schenectady, N. Y., summed up the entire discussion and introduced certain new angles of the power-factor problem which had not been considered previously.

The following committee was appointed by President Johnson to carry on further research upon the question of power-factor, with the idea of making a report containing definite recommendations at the next annual convention of the Association of Edison Illuminating Companies: C. J. Russel, chairman; H. H. Lyon, S. D. Sprong, Dr. C. P. Steinmetz, G. W. Van Derzee, C. S. Dawson, C. W. DeForest, L. L. Elden and W. B. Gear.

CENTENARY OF AMPERE'S DISCOVERY COMMEMORATED.

Tribute Paid to French Scientist at Ceremonies Under Auspices of Crocker-Wheeler Co. at Its Ampere, N. J., Plant.

Impressive ceremonies attended by men prominent in the electrical and other scientific fields were held Saturday afternoon, Dec. 4, at Ampere, N. J., in commemoration of the centenary of the announcement by Andre Marie Ampere of

Prince de Bearn Speaking at Ampere Centenary.

the laws of electromagnetism and electrodynamics. The event was arranged by the Crocker-Wheeler Co., which named the locality where its plant stands in honor of the great scientist.

Dr. Schuyler S. Wheeler, president of the Crocker-Wheeler Co., presided at the ceremonies, and after explaining that the Ampere centenary was really in October but that it had been postponed in hope that Ambassador Jusserand might be able to participate, he introduced Prince de Bearn, charge d'affaires of the French embassy, who expressed gratification at the honor shown a son of France, and after giving a sketch of his life concluded by saying: "What Ampere gave to America was returned by your country during the war period."

The next speaker was Prof. M. I. Pupin, of Columbia University, who had for his subject "Ampere—The Man and Genius." Prof. Pupin interestingly recounted Ampere's early struggles in educating himself, and presented from a philosophical point of view the influence of his studies and discoveries in the development of electrical science.

Dr. C. O. Mailloux, past president of the

American Institute of Electrical Engineers and chairman of the International Electro-Technical Committee, spoke of the early experiments leading to the formulation of the fundamental principles of electrodynamics by Ampere.

After the ceremonies at the Crocker-Wheeler plant, those in attendance adjourned to the Ampere railway station, where in the waiting room a bronze tablet to the honor of Ampere was unveiled by Ambassador Jules J. Jusserand 12 years ago. A bronze laurel wreath placed alongside of the tablet was unveiled by Prince de Bearn.

ELECTRICAL DEVICES EXPOSITION HELD IN VANCOUVER.

The first electrical show under the auspices of the British Columbia Electrical Co-operative Association was held in Vancouver, Can., Nov. 22-27. E. E. Walker, sales engineer of the British Columbia Electric Railway Co. and chairman of the advisory council of the association, was in charge of the show, being assisted by J. F. Little, local manager of the Northern Electric Co., and the following members of the committee: E. Brettell, display and decoration; W. W. Fraser, illumination; J. Muirhead, light and power supply; E. H. Hughes, entertainment; W. C. Mainwaring, space allocation; J. Lightbody, publicity, and H. Pim, finance. The purpose of the exposition was the promotion of the use of electrical devices in Vancouver and adjacent territory. Plans are being prepared for another show next year.

INDUSTRIAL LIGHTING EXHIBIT AT SAN FRANCISCO.

California Electrical Co-operative Campaign Installs Industrial Lighting Exhibit—January to Be Devoted to Lighting Campaign.

The industrial and commercial lighting exhibit of the California Electrical Co-operative Campaign in the safety museum of the State Industrial Accident Commission in San Francisco was opened Nov. 22. D. E. Harris, of the advisory committee of the co-operative campaign, who acted as chairman, stated that the object of the exhibit was to demonstrate and visualize the benefits of correct and efficient industrial and commercial lighting as contrasted with incorrect and inefficient lighting installations. He urged the electrical men to remember that the primary purpose of the exhibit is to sell better industrial and commercial lighting to the public.

W. J. French, chairman of the State Industrial Accident Commission, welcomed the men of the electrical industry and invited their co-operation with the commission in the solution of the various problems affecting safety in industrial plants. He referred to the great advances made during the past 25 years in the various forms of artificial lighting and pointed out the influence which these improvements have had upon the safety and well-being of the people employed in industrial and commercial establishments.

L. E. Voyer, president of the San Francisco Section of the Illuminating Engineering Society, presented the subject of better industrial and commercial lighting with the aid of actual demonstrations of the effect of various systems of lighting made possible with the installations provided for the exhibit. Five separate types of lighting are installed, and by means of a central switchboard and an arrangement of cords and pulleys the various installations can be operated separately or simultaneously, and the effect of height and spacing of units observed. Observations are made at six stations throughout the room by the use of foot-candle meters, and the reading of these meters together with the observation of shadows of various objects placed on tables throughout the room gives a conclusive demonstration.

Mr. Voyer introduced his subject with definitions of the lumen and foot-candle, and stated that with these two units in mind and a few essential facts regarding the size and height of the space to be illuminated the character of illumination demanded by the work to be performed in the room and the characteristics of various lamps and reflectors, the question of determining the correct lighting installation is simplified to a question of ordinary arithmetic and common sense. He then demonstrated the fact that intensity of illumination has a direct effect upon the certainty of vision by means of an ordinary optical chart illuminated with varying intensity by the light from a flood-lighting unit controlled with a rheostat. The relation of quickness of vision to intensity of illumination was next demonstrated with an apparatus having a shutter which uncovered for a given period of time letters and figures illuminated to varying intensity by the same flood light. The effect of unprotected light sources in the line of vision was shown by means of a chart with a hole in the center through which the light from a lamp placed behind the chart was allowed to shine in the eyes of the spectators. The intensity of this light was varied by means of a rheostat, thus showing the binding effect by the difficulty with which the letters on the chart could be read in the face of the light.

In his remarks Mr. Voyer called attention to these various effects in lighting and as the different types of installations were demonstrated, pointed out how the bad effects might be eradicated and the good effects produced. It was interesting to observe how closely the readings of the foot-candle meters from the various stations in the room coincided with the results which Mr Voyer stated would be produced by the different types of installations.

Demonstration of Various Stages of Shop Lighting.

The lecture Saturday evening, Nov. 27, was by Clark Baker, one of the illumination engineers of the General Electric Co., who also conducted the demonstration. The latter comprised exhibits that showed the stages of shop lighting, from the crudest to the best, and the lecturer explained that efficiency and safety have increased with the progress of scientific lighting. Units of quantity and intensity, the use of the foot-candle meter, and the effect of glare were explained and demonstrated.

The California Electrical Co-operative Cam-

paign is now installing a similar exhibit at Los Angeles and is preparing a portable exhibit to be used in other cities throughout the state. The month of January will be devoted by the campaign to the subject of industrial and commercial lighting.

ATLANTIC AND PACIFIC LINKED BY RADIO TELEPHONY.

A new record in long distance telephone communication was made recently, when Col. J. J. Carty, vice-president of the American Telephone & Telegraph Co., seated in the dining room of the Waldorf-Astoria Hotel, New York City, conversed with company officials on Catalina Island, off the shore of southern California, and aboard the steamship *Gloucester,* off Philadelphia. Catalina Island was linked to Los Angeles by radio, Los Angeles to San Francisco, the latter city to New York City by telephone, and New York City to the *Gloucester* by radio. Colonel Carty, who supervised the remarkable demonstration for the visiting members of the American, British, French, Italian and Japanese delegates to the International Communications Congress, said at its close: "This establishes a new record for radio and wire telephony. There had been no previous talk between the Atlantic and Pacific with two radio links."

WATER-POWER APPLICATIONS EXCEED ESTIMATES.

Applications filed with the Federal Power Commission prior to Nov. 20 aggregate 7,726,651-hp. capacity, which greatly exceeds the estimates made during the discussion of the water-power bill in Congress. At that time the most optimistic estimate was that the first year would see applications filed covering 2,000,000 hp. In this calculation the capacities of Niagara projects are rated as limited by the diversion now authorized by the treaty, which if modified to permit the diversion of 20,000 sec-ft. additional the above total would be increased by 400,000 hp. The applications covering projects on navigable streams involve 4,790,350 hp., while those on public lands and reservations involve 2,936,301 hp. The projects which require property valuation involve something like 738,200 hp.

COMMISSION TAKES FIRM STAND ON UTILITIES SITUATION.

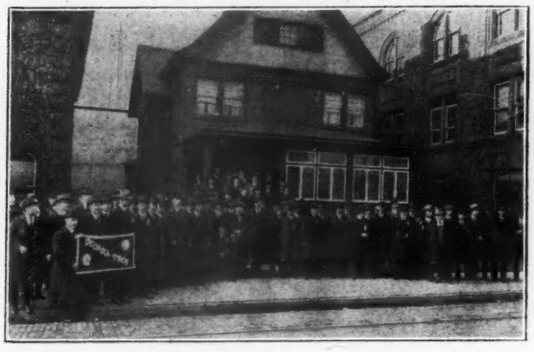
The Public Service Commission of Washington, one of the regulatory bodies now existing in 45 states through which public utilities are regulated, has issued a statement regarding the utilities situation, which says:

"The great majority of people affected have realized that the utilities' expenses, like their own, have expanded, compelling increased revenues. There are some, however, who cheerfully pay $12 for a pair of shoes for which they formerly paid $4.50, or 50 cents for a beefsteak for which they formerly paid 20 cents, and who complain bitterly if the cost of a utility's commodity is increased 25 cents a month; and accuse the commission of favoritism towards the company if any increase whatever is allowed to meet growing wages and material prices. They seem to forget that the bulk of the expense in operating most utilities is labor, and that each member of the great army engaged in rendering public service is compelled to purchase the necessities of life at the same high cost that confronts us all.

"We realize that it is not a popular thing to increase rates. We have it in our power to bring ruin and disaster to many hundreds of utilities and rend the financial fabric of the state. It is difficult now to secure capital for public service enterprise, and this commission, by a rash stroke of the pen, could make it impossible in the state of Washington. We have endeavored in these trying times to save legitimate investment in utility properties from ruin, preserve the necessary public service for the people, and at the same time be just and fair to the patrons who pay the price. If we should yield to the clamor of politicians, whose stock in trade is reckless denunciation of public utilities and abuse of the commission for permitting them to live, the results would frighten even those irresponsible agitators."

GEORGIA COMMISSION MAKING TOUR OF INDUSTRIAL CENTERS.

A tour of the East Pittsburgh plant of the Westinghouse Electric & Manufacturing Co. was made recently by 150 members of the Georgia Industrial Commission, headed by Gov. Hugh M. Dorsey and other prominent men of Georgia. The party is visiting some of the largest industrial cities of the East, the itinerary including Cincinnati, Pittsburgh, Buffalo, Niagara Falls, Boston, New York and Washington. The object of the tour is to interest the people of Georgia in helping to raise an endowment for the Georgia Institute of Technology, so that more young men of the South will be able to take engineering courses and thus provide a stimulus for developing southern industries.



Members of Georgia Industrial Commission Who Visited Westinghouse Plant at East Pittsburgh, Pa.

ENGINEERING OF MEN DISCUSSED AT NEW YORK MEETING.

The results of an extensive study of the three-shift system in the steel industry were presented by Horace B. Drury, formerly of the Ohio State University and recently with the Industrial Relations Division of U. S. Shipping Board, before a joint meeting of the New York Section of American Institute of Electrical Engineers, Management and Metropolitan Sections of American Society of Mechanical Engineers, and the Taylor Society. Mr. Drury presented tables showing the number of men averaging 12 hours per day in the different industries, number of organized trades and important industries which had adopted the eight-hour shift in recent years, and the comparative efficiency of the two-shift and three-shift systems in open-hearth operations, boiler rooms and rolling mills of steel companies.

He stated that the three-shift system had not proved more expensive, since better work and increased production resulted. The advantages of the eight-hour day were so numerous and its disadvantages so few that it was being widely adopted.

LECTURES ON BETTER CITIZENSHIP ARRANGED BY EDISON CLUB.

The Edison Club, composed of employes of the Commonwealth Edison Co., Chicago, arranged a series of six lectures for the 1921-22 season on the general subject of "The Best in Life." So far lectures in the course have been delivered by Dr. J. Paul Goode, University of Chicago; Dr. Newell Dwight Hillis, of the Brooklyn Tabernacle and national chairman of the American nationalization movement, and Dr. Edward A. Steiner, who spoke Dec. 10 on the various "isms," particularly bolshevism and anarchism. This is probably the first time that a central-station company has made provision for an educational course covering civic questions.

NEW ISSUE OF DETROIT EDISON CO. DEBENTURE BONDS.

In a recent letter to its stockholders the Detroit Edison Co. offered a new issue of $5,500,000 ten-year 8% convertible debenture bonds, the proceeds from which are to be used to meet its capital requirements for the completion of work now in progress and that planned for next year. The company also contemplates the issuance of a similar amount of its capital stock. The suggestion has been made to the stockholders that they relinquish their right to buy this new stock so that the company may dispose of the available portion to its customers.

NATIONAL PUBLICITY CONFERENCE PLANNED BY ENGINEERS.

The American Association of Engineers will hold a national conference on engineering publicity this winter, Feb. 25 being set as the tentative date for the meeting. The association plans to prepare a comprehensive program for national engineering publicity predicated largely on the need for informing the public of the service which engineers are performing and asking the co-operation of all interested parties.

TO CLASSIFY ELECTRICAL ACCESSORIES FOR AIRCRAFT.

The National Aircraft Underwriters' Association is arranging to give formal and practical recognition to reports made by the Underwriters' Laboratories covering the design and equipment and the insurance classification of aircraft. The management of the laboratories is now developing plans for a special department to handle the engineering and technical plans of the aircraft problems. Consultation and co-operation with industries has long been a fundamental principle of the laboratories' procedure, in accordance with which cordial relations have been established and maintained with manufacturers' organizations such as the Associated Manufacturers of Electrical Supplies. The examination and test work to be done by the laboratories in connection with the listing of various materials and devices employed in the assembly and equipment of aircraft is divided into classes, among which is listed electrical accessories, lamps and lamp fittings, wires, cables, switches, relays, generators, motors, batteries, etc. The laboratories contemplate the publication of lists of such appliances corresponding to its present lists of inspected electrical fittings, mechanical appliances, etc.

NEW JERSEY DECISION ON SERVICE CONNECTION CHARGES.

The Board of Public Utility Commissioners of New Jersey has handed down a decision in cases brought jointly by the Public Service Electric Co. and the Public Service Gas Co., Newark, relative to increased charges recently made for service connections. On Sept. 1 the electric company placed in effect a charge of $12 to the average consumer for electric connections. The board holds that such an increase is unjust and unreasonable and states that where free connections were made prior to the date noted that such practice should be resumed. Where fixed charges are specified in the rules and regulations for companies beyond free limits, the board holds that charges may be made, but these must be based on the actual cost rather than on fixed sums. The board holds further that it has no power to award reparation to consumers who have paid the increased charges since the new regulations became effective, but recommends that such charges be refunded.

DISCUSS MODERN PHOTOGRAPHY AT A. I. E. E. MEETING.

The direct and indirect uses of modern photography were discussed by Arthur Palme, General Electric Co., Pittsfield, Mass., at the 229th meeting of the Schenectady Section of the American Institute of Electrical Engineers, held at the Edison Club hall, Schenectady, N. Y., Dec. 3. Mr. Palme explained the photography of natural colors and how colors may be reproduced mechanically, and described the Lumiere autochrome process.

COMING CONVENTIONS.

Western Association of Electrical Inspectors. Annual convention, Detroit, Mich., Jan. 25-28. Headquarters, Hotel Statler. Secretary, William S. Boyd, 175 West Jackson boulevard, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention and lighting fixture market, Elmwood Music Hall, Buffalo, N. Y., Feb. 14-19. Secretary, Charles H. Hofrichter, 8410 Lake avenue, Cleveland.

State Utility Associations. Annual convention and joint meeting of Illinois State Electric Association, Illinois Electric Railways Association and Illinois Gas Association, Chicago, March 15-17. Headquarters, Sherman House. Secretary, R. V. Prather, Springfield, Ill.

National Fire Protection Association. Annual convention, San Francisco, June 14-16. Secretary, Franklin H. Wentworth, 87 Milk street, Boston.

American Institute of Electrical Engineers. Annual convention jointly with the Pacific Coast convention, Salt Lake City, Utah, June 20-25. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

CITY OFFICIALS' RESPONSIBILITY IN UTILITY MATTERS.

President of California Railroad Commission Points Out Duties of Municipal Representatives in Regulation of Public Utilities.

Criticism of rate commissions for granting public service companies increased rates to meet existing conditions, received an adequate answer from E. O. Edgerton, president of the California Railroad Commission, in a recent address before the League of California Municipalities, composed of city officials. The commissioner took city officials who make misstatements seriously to task, declaring that notwithstanding substantial increases in rates, there "has been no profiteering" in utility services in California, and that the state's industrial progress depends upon an immense increase in the facilities of the companies performing public utility service, which expressed in money, means investment of several hundred million dollars in the next few years. He said there is no power to force investment in securities of these companies except through adoption of a sound policy which insures the investor that his property will be dealt with fairly and intelligently.

Continuing, Mr. Edgerton said: "You, who are the official representatives of municipalities, have a very serious responsibility. It is your obligation when you advise your constituents on public utility matters that you not only state the facts as you are informed, but that you fully inform yourselves before attempting to speak. That you may wound the feelings of a public official by hasty insinuation or direct charge of misdoing, is not important. It is important, however, that you do not by misstatements, either purposely or ignorantly, shake the confidence of the public in so important a matter as the regulation of public utilities. If you do so you are doing your constituents a serious injury. You must recognize that these investments are made in the common good; that they develop communities, and realize that they are protected by the constitution of the United States and the laws of the state, designed to protect such investment against confiscation."

METER READING IMPORTANT DETAIL OF UTILITY BUSINESS.

The value of correct meter reading is recognized by all the central-station companies as one of the phases of the industry which tends to create public good-will. For the purpose of making more accurate the work of this important detail of the business, the United Electric Light & Power Co., 130 East 15th street, New York City, has prepared in pamphlet form a set of rules and regulations for meter readers, incorporating the school course for such employes. The company has also issued a sheet entitled, "Notice to Indexers," which is used for the inside cover of the employe's index book, and is a constant reminder of the high lights he is expected to remember and put in practice during the course of his day's work.

PUBLIC UTILITY OPERATIONS FROM CONSUMER'S VIEWPOINT.

Value of Cultivating Customer's Good-Will Pointed Out in Paper Presented Before Convention of Empire State Gas and Electric Association.

By G. I. VINCENT,
Engineer, Syracuse (N. Y.) Lighting Co.

It is a reasonably safe assertion that the efforts of large utilities to secure the genine good-will of the majority of their consumers have not been entirely successful. That this has not been universally so in the very small utilities is also true. Inherently, there is no reason why the customers of a public utility should not have for the utility the same regard which they have for the merchant from whom they purchase their supplies. In fact, the utility should commend the good-will of its customers to an even greater extent, because the product is cheap, the delivery instantaneous, quality uniform and the meters by which the cost is measured are more accurate than the scales and measures which are used to determine sales of other commodities.

Admitting that this condition exists, it is pertinent before attempting to apply a remedy to inquire as to the cause. However, on putting the question to a number of competent managers it was found that opinions varied so widely, or in some cases were absent altogether, that the writer concludes to accept the condition as it is and inquire if any remedy can be applied. Let us consider for a moment a comparison between the utility's system and the business of a large department store. For the sake of establishing a working hypothesis it will be assumed that the department store has its customers' good-will because it has examined all its activities from its customers' viewpoint, and this the utility to a large extent does not do.

Accepting this hypothesis for a moment, it will be admitted at once that it is a comparatively simple matter for the department store to secure the customer's viewpoint, and an equally difficult matter for the utility to secure it. The reason for this is obvious. The customers of the department store come in intimate contact with the employes when practically every purchase is made. The employe's job depends on making the customer satisfied. The officers and department heads in a large department store are constantly analyzing their business from the customer's point of view and passing the results of their in-

vestigations down to the employes, who come in direct contact with the customer. The accounts of a large department store indicate that their customers come to the store about four times per month. The consumers of a utility of course do not average anything like this. The majority of consumers' visits to the office of the utility are to pay bills and in the very nature of this there is little opportunity for the cultivation of the consumer at this time.

There is of course very much more to be said on both sides of this comparison, but only this much will be taken up in order to make the point. The conclusion clearly is that the utility must find some possible way to bring its employes in more frequent contact with its customers and to take advantage of that contact by developing to the highest degree the personal element. "But," says the progressive manager, "we are already giving the very best service. The quality of our product is uniform, electric interruptions are practically unknown, our office employes are courteous and our trouble men well trained, etc. All this can be granted, and yet the manager will not, by any means, have the good-will of his consumers. If he could do all the work in contact with the consumers personally and was the right kind of a fellow, he would undoubtedly have their good-will, but of course this would be utterly impossible in a utility of a large size.

During the last decade we have been taught that efficiency will be acquired by specialization. Scientific efficiency fundamentally requires the highest degree of specialization and it has found its way into all the activities of modern and well-managed utilities. This may apparently make for low costs in our operation, but we are not running a factory. Should we not think of our income not only as the dollars and cents which are paid to us for our products, but also the intangible income, the high regard of our consumers, which will enable us to conduct our business and secure rates that will enable us to attract capital and supply the community to the greatest advantage to all?

Suggestions for Improving Service Rendered by Utility.

It is not asserted that the service which has been regarded as good service by the utilities has in all cases been poor. It is simply stated that in most cases the service as given has not been analyzed from the viewpoint of the consumer, and has, therefore, produced little good-will. We must remember that the consumer knows practically nothing about the business of the utility. To him little mistakes which would scarcely be noticed in the operations of a utility may appear as glaring errors and stupid or deliberate inefficiency. It is a fact that many consumers who call to give a trouble order are unaware they are one of many, and it is incredible to them that somebody is not waiting to go out and attend to their difficulties? This, of course, can be remedied by explaining the matter to the consumer in detail.

To bring this matter right home, let us examine a few of a utility's activities, purely from the consumer's viewpoint. In other words, it will be necessary to forget completely all that we know about the operation of our utility. Assume then that you are the consumer, knowing nothing whatever of the business.

(1) You receive a bill, which you honestly and sincerely believe to be too large. You call at the utility's office to protest. You are given a stereotyped line of explanation, but are still unsatisfied. Finally it is agreed that your meter will be tested. In due course you are notified that your meter is correct. Has your regard for the utility increased?

(2) You move to a new location and make application for electric service. In due course a man arrives, but because of errors in the company's records, lack of city permit, lack of inspection or for some one of the many other reasons quite beyond control, you are left without supply for a day or two or perhaps longer. Has your regard for the utility increased?

(3) You make application for service, and receive it. To the employe who calls at your premises you indicate a desire for further service. But this employe is a specialist and cannot give it, so in due course, he having reported it back, another specialist arrives. To him you indicate a desire for further service at some other point but he is also a specialist and cannot do this. In course of time all that you want is accomplished, but what is your opinion of the utility and its operation?

(4) You have a laundress at work on your premises at probably $3 a day and carfare. The electric washing machine breaks down. You call for service and are referred to the dealer from whom you purchased the appliance. In the course of two or three weeks the dealer's representative arrives and puts it in order. What is your opinion of the utility's service?

These could be multiplied but the four are characteristic and will indicate four serious defects in the effort to give service and obtain the consumer's good-will. First, a lack of knowledge on the part of the employe coming in contact with the consumer of all the activities of the company; second, incomplete records or lack of ready reference in the records; third, over-specialization in operations, and fourth, turning over to others business which we should be attending to ourselves.

The first of these needs little comment. Every employe coming in contact with the consumer should not only know thoroughly the business to which he is assigned but know enough of all the rest of the business so he can intelligently discuss the matter with the consumer. The second difficulty is clearly connected with the third and usually comes from over-specialization. It is entirely possible to so keep the records of a utility that when a consumer desires service for any reason whatever, the employe waiting on him can tell him more about his premises than he knows himself. By suitable combinations the operating costs would probably not exceed the present methods after the first installation was paid for.

Over-specialization has undoubtedly resulted in increased rather than decreased costs in a large number of situations. Further it bothers the consumer, and, of course, this we want to avoid. It might be stated that if we desire many contacts between the consumer and the employes that there would be some merit in sending second

employes to do each special kind of work. This might be true with the second, or possibly the third employe, but when it reaches the tenth or eleventh, and in one actual case the thirteenth employe, to do something that one employe should have done, it should be perfectly clear that anything but good-will will be secured.

It is essential that all employes coming in contact with the consumer should be constantly trained to use his best efforts to cultivate that consumer's good opinion of him and of the company.

Training Workmen for Household Appliance Maintenance.

Turning over our merchandising business to others has progressed at an accelerated rate during the last three or four years. It would appear in the first place that the tendency to go out of the merchandising business by utilities was all wrong. On the contrary, they should go into the merchandising of the appliances using their products and to the maintenance of their appliances to a greater extent than ever before. This business, both the selling and the maintenance, will, of course, take care of itself financially if properly managed. The point is that in selling desirable appliances to their customers the utilities have gained a point in their favor and by maintenance this can be carried on indefinitely. But this does not mean the kind of maintenance that has frequently been given heretofore. The maintenance should be practically instantaneous and complete on one visit. To do this would require the training of a corps of high grade workmen, who would be thoroughly familiar with all household appliances. The meter and trouble work should also be handled by these men.

Each one of these men should be assigned to a particular district in the community and work in it. His equipment being complete for a full day's work, with surplus, it would only be necessary for him to return to his headquarters at the end of his day, keeping in touch in the meantime by telephone, and taking orders. The equipment should include a complete supply of such articles as lamps, fuses, cords, mantles, glassware; in fact, anything that in all normal operation would be required by the domestic consumer. By keeping the man in one district, it is perfectly obvious that in the course of time he will come to be known by the residents of the district.

In the general office and salesroom of the utility, the consumer with his diversified wants comes in contact with a comparatively large number of employes. It is suggested that this could all be changed and have one employe assigned to each district, so that when a consumer from that district called at the office he would see this employe, who would attend to all his wants, from selling a lamp to adjusting an account and receiving it. Further, in the general offices of the utility a card index showing the exact condition of the equpiment on every consumer's premises, including finished work and work under way of all descriptions, together with the credit of the current consumer, etc., would enable the employe representing each district to deal intelligently with practically everything that the consumer would require. It will probably be found that this system will cost no more than any of the present methods, when everything is taken into consideration. Here again we have the consumer becoming acquainted with an individual personality.

Of course it is realized that we have an employe on every consumer's premises once a month in our meter readers. Here is a point of contact that with very few exceptions has never been used. It is a question whether the meter readers should not be increased in number and that in addition to reading the meters they should actually solicit consumer's trouble orders and wants and also collect the bills at the time the meter is read.

In appliance installation work the work could probably best be handled by having a group of men under an inspector, the quantity of work determining the number of men. Probably one inspector could safely handle five men, and not only would he look after the installations, but take care of all the routine sales coming in his district. Depending on the amount of business, the district might not be the same as the district of the meter reader or the district of the light order work, or again the office district, but again the inspector becomes the personal entity in his district.

Newspaper advertising should be continuous but probably quite different in form from that heretofore used. The object should be to acquaint the consumers intimately with just what the utility is doing all the time in all its departments. Pictures of the various employes and descriptions of their work will form an important addition to the effort to make them known personally to the consumers. The story and newsy form should be used. Appliance sales advertising, if used at all, should be incidental.

The whole point of this suggested organization is to bring consumers in contact with a competent person known to them personally to the entire satisfaction of the consumer, at frequent intervals. The thought is to get away from the perfunctory attention that will almost invariably result from over-specialization. If the theory is reasonable it will increase the sales of basic products by increasing the sales of appliances, and it will go far to secure the good-will of consumers in just the same way that the merchant secures the good-will of his customers.

It is highly probable that the consumer who owns any securities, no matter how little, of the utilities in his town will at least be steering along the friendly road.

UTILITY COMPANY OFFERS STOCK TO ITS CUSTOMERS.

With the desire of having its securities as widely distributed as possible among its customers, the Narragansett Electric Lighting Co., Providence, R. I., has offered a limited quantity of its 8% preferred stock to consumers who are not already stockholders, applications being restricted to five shares. The stock purchased under this plan may be paid for in cash or in quarterly payments beginning Jan. 1. Some time ago the company offered its preferred stock under a subscription plan to its employes, over 200 subscribing for 1012 shares.

CONTRACTOR-DEALER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Goods

BASE ADVERTISING APPROPRIATION ON RATIO OF SALES.

Valuable Information Offered Contractor-Dealers Who Seek Guidance in Obtaining Proper Share of Appliance Business.

Many contractor-dealers in various parts of the country have been taking advantage of the Westinghouse "Better Merchandising Shows" to

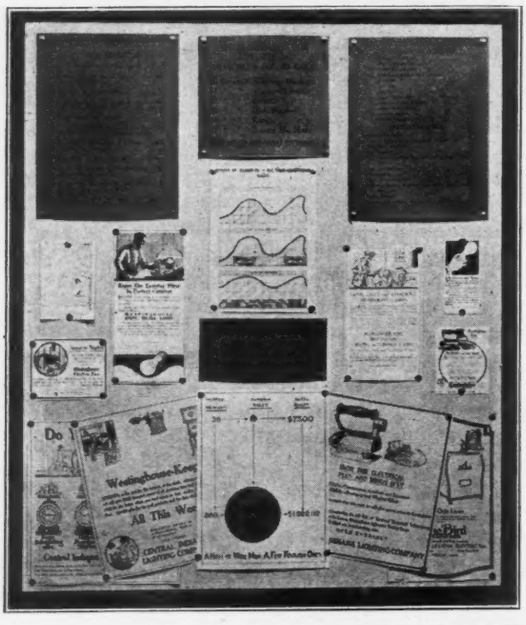


Chart of Advertising Statistics and Suggestions to Help Electrical Dealers to Greater Sales.

obtain new angles in modern merchandising as applied to electrical goods. One of the subjects given particular attention by visitors at these shows is that of advertising.

Among the charts exhibited and explained by experts in charge of the shows was one which gave estimates of the sums that dealers could advantageously expend for each electrical appliance they hoped to sell throughout the year. Another chart gave some sales statistics and estimates that included the possible number of various appliances which should be sold for every 1000 of population. The two charts are shown herewith.

It was suggested to dealers that the sales per 1000 of population should closely approximate seven vacuum cleaners, five clothes washers, two sewing machines and one each of the ironing machine, dishwasher and electric range.

Sales estimates of electrical goods for 1920 were also made. Among the leaders in this year's sales, fixtures and portables should approximate $295,000,000; batteries, $160,000,000; lamps, $153,000,000; wire and lamp cord, $140,000,000; washing machines, $100,000,000; motors, $100,000,000; wiring devices, $85,000,000; heating appliances, $43,000,000; vacuum cleaners, $40,000,000; fans, $25,000,000; wireless apparatus, $25,000,000; refrigerating machines, $16,000,000; ironing machines, $10,000,000.

On the chart which shows samples of advertisements furnished dealers by the manufacturer there was included an estimate suggesting the following amounts which could properly be expended in advertising: $5 for each washing machine, $1 for each vacuum cleaner, $3 for each ironing machine, $2 for each dishwasher, $3 for each range and $1 for each sewing machine.

Advertising "don'ts" on the same chart suggested:

Don't fail to advertise if you have something to advertise.

Don't leave the copy to the office boy's aunt; she can knit better than she can write advertising.

Don't make statements you cannot support in practice.

Don't try to put a full page of copy in a quarter-page space; better put a quarter-page of copy in a full-page space. Bull's eye.

Don't forget to follow up your advertising.

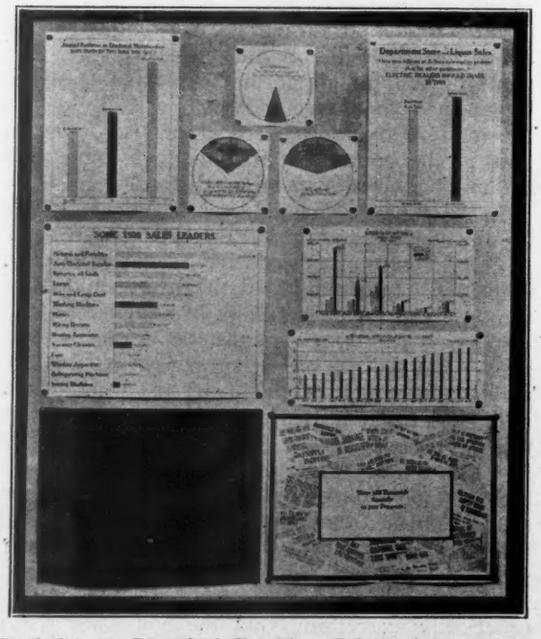
Don't pick a thin, skinny type, but one that has a bold, courageous face, typical of strong and dependable business.

Don't give more than one bright idea in an advertisement; to do so may endanger your future stock.

Don't express in words what a picture can portray—use illustrations.

Don't be a spasmodic advertiser. It is the constant dripping of water that wears away the stone.

Don't expect to check definite results. If you have no faith you had better leave advertising alone.



Statistics on Electrical Retailing Exhibited at "Better Merchandising Shows."

Business Hints for the Dealer

Helping Utility Ships to Make Port in Storm — Electrical Sales Policy—What Trade Journals Are For—Profitable Show Windows

At practically every convention of state associations of contractor-dealers recently a conspicuous place on the program has been given to the discussion of public utilities, particularly the financial condition of central-station companies and their difficulty in obtaining adequate rate relief from state utility commissions. The contractors and dealers of at least two states, Indiana and Tennessee, have passed resolutions pledging individual and collective support of the central-station companies of their respective states. The old spirit of suspicion and merchandising antagonism seems to evaporate before the pleas of the central-station representatives who have come to the contractor-dealer conventions begging for relief and support of this fountainhead of the electrical industry. The contractors and dealers appear to have buried any feelings of distrust they may have had and have readily promised to do whatever they can to help the utilities.

At the state convention of the Indiana Electrical Contractors and Dealers in South Bend last week W. L. Goodwin, from whom the contractor-dealers of the country have received an immense amount of valuable information and support in building up the sales of electrical appliances, surprised the members by devoting the greater part of his talk to the need of the central-station companies of the support of all branches of the electrical industry, particularly of the contractor-dealers. Mr. Goodwin, in reviewing the public-utility situation of the country, said that the life of the electrical industry, particularly the life of the contracting and merchandising business, depended upon allaying the general antagonism of the public, the securing of better rates and the sale of more securities with which to extend lines and increase power-plant capacity.

To put it as plainly as did Mr. Goodwin, the co-operation that is asked by the central-station companies is, that the contractors and dealers invest as much as possible in their securities, that they use what influence they have with legislators toward securing better utility laws and more reasonable commission rulings, and that the contractors and dealers in their contact with the public spread a better sentiment for central-station companies and encourage the buying of securities by users of electricity and electrical appliances. It is pointed out that the failure of a public utility to grow and extend its lines and increase its equipment means the stagnation of business in the community it serves, with a consequent failure to grow larger and develop more business for the contractors and dealers.

It is certain that the central-station companies have arrived at the point where they are not ashamed to make acknowledgment of the might of the contractor-dealer. The contractor-dealers, on their part, are showing at every opportunity their might by promising to take up the battle for the growth and development of the utilities. Some are purchasing utility securities and others who cannot afford to invest are spreading the gospel of "live and let live" for the utilities.

How Sales Policy of Electrical Industry Benefits Contractor-Dealer.

In a recent issue of a house organ of the Benjamin Electric Manufacturing Co. somebody defined "Sales Policy" in a way worth repeating in part. It was pointed out that the manufacturer of a product or line of products is first confronted with the necessity of establishing a method through which his goods shall be distributed to the user or consumer. Under primitive conditions mere barter or exchange of goods sufficed. Later developments of society necessitated specialization by men in various forms of commerce, one a manufacturer, another as a "warehouser" or distributor of fabricated goods. Out of this latter class has grown, first, the wholesaler who often gathers products from all over the world and keeps them in stock for the benefit of the retail stores in his territory; second, the retailer or the man who is directly in touch and cares for the needs of the consumer or user of such products.

Another channel of distribution is that employed by the manufacturer who seeks to serve the consumer directly, a method in vogue in certain industries. Theoretically it is much in favor in certain circles because it logically appeals as being the shortest route "from maker to consumer." This sales policy, however, is often complicated through the fact that stocks must be held at a great many points in the territory served in order that the consumer can conveniently obtain them when needed. The impatient public no longer waits for months for deliveries as it did some decades ago.

In the natural growth of the electrical industry certain wholesalers have grown into the business and performed certain distinct functions which, otherwise, the electrical manufacturers would be required to undertake. These functions are: (1) Selling service, wherein the selling expense and service is distributed over a number of different lines, resulting in distinct economy; (2) The warehousing, or storing of products salable in the wholesaler's immediate territory, thus relieving the manufacturer of that part of the work; (3) The carrying of a multiplicity of small accounts—the better handling of credits due to a more intimate contact with the territory; (4) A quicker serving to the retailer, and through him the consumer, due to increased convenience and better service which the wholesaler offers.

Undoubtedly, the "supply-jobber to contractor-dealer" system of distribution so thoroughly adopted in the electrical industry, serves to perform all the functions named above. It also

proves economical when it comes to a consideration of the cost of distributing electrical supplies and equipment. Through this system, also, the manufacturer and jobber are able to co-operate more intimately wtih the contractor-dealer by including in their service the necessary literature for consumer distribution, materials for trimming window displays and copy for local newspaper advertisements.

Show Windows Sometimes Reflect Conditions Inside Store Too Well.

According to the Benjamin *Reflector* the term "show window" is misused in describing that important adjunct to an electrical dealer's salesroom. The term seems to fool many of them. The peculiar thing about a show window is that it is very likely to perform very thoroughly whatever function is required of it. It is often thought of as just a plain window through which to let in the light. It does—when clean. Again it is conceived as a means to show passers-by what kind of a business is carried on inside. It usually does—sometimes too well. Frequently it is regarded as a place to put on display odds and ends of accumulated stock with the hope that someone will see and want them. They are constantly seen but never wanted. A window will sometimes be seen cluttered with merchandise, among which a passer-by may get a clear view of one particular article by a laborious process of eye-focusing to the exclusion of all the other articles.

Then, there is the show window which is being used for the purpose for which it was intended from the first—to sell goods. Its number is on the increase among electrical stores. It is so different from the others. In the first place it is perfectly clean and the glass is glittering. Next, a lot of thought has been given to the arrangement of its contents. It reflects the businesslike but welcome cheeriness of the store beyond. It seems to speak and say: "Come in and let our sales people show and tell you more about these things that attract your attention here."

That is the true show window. It is in taste. Its color pleases the eye. It is light and bright. A few articles have been thoughtfully arranged in such a manner as will best show their effect or purpose. This window does not cost much, but it does take some thought and interest. It is the contractor-dealer's least expensive but most powerful selling medium—the silent but never tiring salesman.

Successful dealers never neglect their windows. The manufacturer, the jobber, the association to which the contractor-dealer belongs, all have arrangements and plans for making the most of a window display. Manufacturers and jobbers are going as far as sending expert trimmers around to dress the windows of dealers who handle their products.

What Trade Journals Mean to the Electrical Industry.

At a recent meeting of contractor-dealers in a certain middle-western city a discussion arose as to the advisability of the establishment of an association paper or journal for the benefit of the members of the state association. "It will be a simple matter to obtain sufficient advertising to pay the cost of publishing the paper," said one of the speakers.

After the discussion had been in favorable progress for some time there arose in the rear of the room a man who has, through patient and persistent efforts in their behalf, earned the respect and confidence of most of the electrical contractor-dealers of the United States and Canada. This man was William L. Goodwin, special representative of the General Electric Co. and founder of the "Goodwin Plan" of merchandising. He spoke quietly but forcibly while every contractor-dealer in the room listened with intent interest.

"Do you men know what you are about to do?" asked Mr. Goodwin. "You are about to forget that your business of contracting and merchandising demands your fullest attention, and you are about to branch out into the publishing business—a sideline with which you are unfamiliar and the expenses for which you propose to saddle upon those whom you expect to contribute to your advertising columns."

Mr. Goodwin then went into detail to show what would result if every state organization of contractor-dealers, and every city association would start its own little publication. There would be several hundred such papers, all demanding the supporting advertisements of the manufacturers and jobbers whose goods the members handled. He further pointed out the inability of such association organs to supply their member-readers with the high class of electrical intelligence and information furnished by the established trade journals that have devoted years of energy and vast sums of money to build up valuable mediums for the benefit of the electrical people. Upon Mr. Goodwin's advice the contractor-dealers present at the meeting quickly decided to drop the subject and rely upon the legitimate trade journals.

In a recent issue of the house organ of the Beardslee Chandelier Manufacturing Co. there was printed under the caption "What the Trade Papers Means to You," the following message to dealers:

> If there is one thing above another that should have the attention of the business man of today it is the trade paper. To keep posted in the things pertaining to his business and that which is necessary to accomplish the best results he should carefully peruse the paper that represents his trade.
>
> The reading matter of the trade paper has improved wonderfully and is worthy of the consideration of its readers. Those who scan its pages closely from month to month profit greatly by the information received.
>
> When a man fails to enjoy reading or talking about his business it is usually a conclusive sign that he is on the down grade and it won't be long before he reaches the bottom. Pride in business creates enthusiasm and every article written appeals to him as does drink to a thirsty nature. All successful men are looking for every scrap of information and they are, as a rule, diligent readers of the papers which represent their trade or profession.

J. W. Collins, secretary of the Electrical Contractors' Association of Chicago, tells of his method of disseminating items of intimate interest, announcements of meetings, reminders re-

garding the payment of dues, etc., among members of his association. This is accomplished by issuing a mimeographed bulletin twice a month and mailing it to members in a one-cent open envelope. The cost of this system is negligible and is fast finding favor among other electrical contractor-dealer associations.

BRINGING CHRISTMAS UP TO DATE IN WINDOW DISPLAY.

Appeal to Holiday Spirit Is Made by Display of Airplane for Use of Santa Claus in Distribution of Electrical Gifts.

The Walker Electrical Co., Providence, R. I., sells merchandise that was not so much as thought of a generation ago. Hence it is only natural that it should decide upon a more modern version of Santa Claus than a sleigh and reindeers. In these days of automobiles and airplanes it is natural to expect that the youngsters are not going to be satisfied to see old Saint Nick using the same kind of transportation that he used when their ancestors were using oxen.

For this reason this company made the feature of its Christmas window display for 1919 an airplane. A 20-in. model of a Curtiss land machine was used and suspended in the window by means of invisible wires. The machine in that position attracted some attention but it was desired to give it the motion that makes any window more attractive. Accordingly, an electric fan was placed in one corner of the window and directed toward the propeller of the machine. It was found that this would not make the propeller spin in a satisfactory manner so the propeller which came with the machine was replaced with a celluloid windmill, or whirligig, such as delights the hearts of children on circus day.

WORKIHG MODEL OF AIRPLANE ATTRACTS ATTENTION TO DISPLAY.

This many colored substitute for the regulation propeller served its purpose admirably. The bright spot of whirling color served to attract attention and there was no difficulty in driving it at the desired speed with the breeze from the fan.

The fan itself was concealed by means of a paper screen placed between it and the window. The paper used was decorated, showing Christmas pictures, and the screen was only large enough to cover the required amount of the lower part of the window and the fan itself, yet leave plenty of room for the free circulation of air around and from the fan.

An additional touch was given to the attention-attracting value of the airplane by placing a three-cell battery in the fuselage and using the current to light little lamps on the wings and body of the airplane after dark.

Although there was no Santa Claus driving the machine, the paper decorations showed that it was a Christmas display. The airplane itself gave a subtle suggestion, which one could not escape, that the portable lamps displayed on the floor of the window were entirely up to date.

This airplane, therefore, in this display served three purposes. The vari-colored whirligig propeller was an attention-getting bright spot of color. The motion set up by the breeze from the fan compelled attention as nothing but motion can compel it. The model itself brought out one of the sales arguments of the merchandise displayed, the fact that it was thoroughly up to date and that to be up to date one should buy it. To a certain extent there was still another point about this display that helped to gain attention. This was the illusion that it gave of an airplane actually floating in the air. At first glance one could see no means of support. There was certainly nothing to make the propeller go. The whole thing tended to attract curiosity in no mean proportion and at the same time it fitted in admirably with the goods for sale.

AIRPLANE ATTRACTS IN ELECTRIC WINDOW DISPLAY.

Dealer Uses Popular Modern Invention in Timely Comparison With Electric Appliances and Greatly Increases His Sales.

Current events lend themselves readily to application in electric window displays. In an eastern electric store there was recently conceived and executed the trim for the electrical show window shown herewith. With the crude model of

Window Display With Timely Application of Modern Invention Household Appliances.

an airplane suspended in the center, the window was dressed with a view to the timely comparison between modern inventions.

This idea is in keeping with the adaptation of current events to displays and may be made to apply with popular inventions in the windows of dealers everywhere. As in the case of the window display shown herewith, the idea is sure to attract unusual attention and impress the observer with the value and utility of modern electrical appliances, resulting in greatly increased sales.

QUESTIONS AND ANSWERS

All Readers Are Invited to Submit Contributions on Electrical Matters to This Department—Answers Should Be Sent Within Eight Days of Date of Publication of Question—Payment Will Be Made for All Answers Published

Questions.

No. 510.—Advisability of Holding Sales of Electrical Goods.—I have been endeavoring to learn from various sources, including jobbers, dealers, etc., the advantages to be gained by and the difficulties met with in conducting a sale or sales of electrical goods. Other merchants have sales for the purpose of raising money, reducing stock, and cultivating new customers, and I want to find out if the electrical dealer can benefit by following their example. Will dealers or others in touch with the situation give their views on the subject?—W. R. B., Phoenix, Ariz.

No. 511.—Transformer Operated at Higher Frequency.—I have a 10-kw. transformer rated at 2200 to 220 volts and 25 cycles. I would like to use this transformer on a 60-cycle line, but am afraid it will overheat or possibly burn out as soon as it is connected up. Will someone kindly advise me as to what would happen if such a transformer were connected to a 60-cycle line? How much load will it carry without overheating? What capacity fuses should I use on the high-tension side to protect the transformer? This is an ordinary oil-cooled outdoor transformer with four primary and four secondary terminals.—F. H. B., St. Louis, Mo.

No. 512.—Proper Size of Wire for Long Motor Circuit.—What is the correct size of wire to use in running a 440-volt, three-phase circuit to a 50-hp. induction motor located approximately 6100 ft. from the power house? The motor will run a centrifugal pump requiring an input of about 35 or 40 hp. for three or four hours each day. Would it be cheaper, or save any power, if transformers were used to increase the voltage to 2300? Can I use a synchronous motor on 440 volts and get as good results as using the induction motor with transformers to raise the line voltage?—R. L. T., Rochester, N. Y.

No. 513.—Leading and Lagging Current in Synchronous Motor.—In the Nov. 13 issue of Electrical Review A. S. L. said in answer to question No. 495, "These facts are so well known that proof is not necessary, though simple physical nonmathematical proof is easily possible." I have studied the answers given to question No. 495, but am not sure that I fully understand the action of a synchronous motor as a condenser yet. Will A. S. L., or someone else, explain more fully the points referred to in the above quotation?—S. B. H., Portland, Ore.

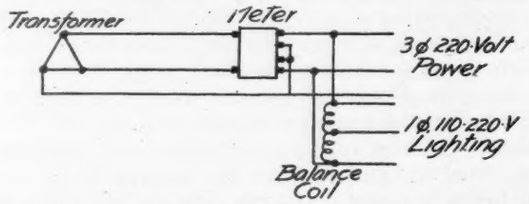
No. 514.—Illumination of a Machine Shop.—What is the best method to employ, and what intensity in foot-candles should be used, in lighting a fairly large machine shop? The shop in question is 50 by 200 ft. in size, and has a saw-tooth roof with windows all along both sides and the ends. Drill presses, planers, shapers, saws, milling machines and other tools all have individual motors so that there are no belts to interfere with overhead installation. Should a system of general illuminating be installed, or would a mixed system of general and local lighting be better or cheaper? What special provision should be made for the work benches along the sides of the shop? If general illumination is best, what intensity should be used, and what size lamps would give the best results?—N. S. T., Detroit.

Answers.

No. 503.—Metering Combined Power and Lighting Load.—Will someone kindly explain how a metering equipment should be laid out to properly measure the power delivered to a combination of lighting circuits and three-phase motors? Service is supplied from a delta-connected bank of three 15-kw. transformers. The lighting load, which has a maximum demand of about 4 kw., is connected between the two sides and neutral of one of the transformers. This lighting load varies from a small amount during most of the day to the maximum for about three hours. The power load consists of seven 3-hp. motors, four 5-hp. motors, two 7.5-hp. motors and two 10-hp. motors.

The motors are all three-phase, 220-volt induction motors and do not all operate at the same time. The lighting circuits operate on the 220-110-volt, three-wire system and are often badly unbalanced. Maximum demand must be measured as well as the total power consumed.—J. O. R., Kansas City, Mo.

Answer.—Single-phase lighting, when metered with a three-phase power load, should be taken



Sketch Showing Method of Making Meter Connections.

from a balance coil as shown in the accompanying sketch. Printometer or graphometer connections are made in the usual way.—W. H. K., Evanston, Ill.

No. 505.—Energy Required to Heat Water.—I am considering installing an electric water heater in my home and would like to know what amount of energy it will consume. Will someone who has had experience with heaters kindly advise me as to how many kw-hrs. per month are required to heat water for a family of three?

Is a tank heater more economical than an instantaneous faucet heater? Can a tank heater be connected to the ordinary house circuits, or will special connections have to be made?—J. E. R., Chicago.

Answer.—A 750-watt tank heater of either the insert or external type will suit a family of three. This heater should be left constantly in circuit, many central-station companies giving an exceedingly low rate for such service. The current consumption in such a case would be 540 kw-hrs. per month, but would be lowered by the use of a regulating thermostat. Experience with instantaneous water heaters indicate that they are satisfactory where only small quantities are required and time of delivery is no object. The latter type of heaters only consume energy when water is being drawn, but the flow is purposely retarded in order to allow the required time for the water to attain the necessary temperature. For general family use the writer has found the tank heater to be superior to other types.—J. S. Cumberland, B. C.

No. 506.—Carrying Capacity of Wires.—Why is it that wiring codes, as a rule, do not allow circuits in houses to be fused heavier than for 10 amperes while giving the capacity of No. 14 wire as 15 amperes? Since No. 14 wire is required by these same codes it seems that, unless there are other limitations, the circuits could be safely fused for the safe capacity of the

wire. If there are other limitations, what are they and how can they be overcome?—J. A. C., Kankakee, Ill.

Answer.—The intent of this rule is to insure the protection of the sockets, flexible cord, fixture wire and receptacles against heavy overloads. Take, for instance, a fixture wired with No. 18 fixture wire. As the carrying capacity of No. 18 wire is only 3 amperes it can readily be seen that if a ground or partial short-circuit should occur in the fixture wiring, and the circuit was fused for 15 amperes, the No. 18 conductor would be much overloaded. Also many of the sockets, receptacles and single-pole switches used on these circuits are not designed for carrying large currents.

In general, it is best not to fuse lamp circuits above 6 amperes as such practice minimizes the number of lamps which will go out if a fuse blows. But 10-ampere fuses may be used in spite of the fact that the capacity of No. 18 wire is only 3 amperes. This is because fixture wire is generally protected by the inclosing tubing and even though it became heavily overloaded could not cause much damage.—W. J. M., New Bedford, Mass.

Answer.—There are several reasons for allowing fuses of only 10 amperes on branch circuits of 125 volts or less, while at the same time No. 14 wire is required which is good for 15 amperes. A branch circuit is permitted to have a maximum load of 660 watts at 110 volts, the current at this load being 6 amperes. Therefore 4 amperes of overfusing of the circuit is permitted to take care of any reasonable fluctuation. The conductor itself is underfused to the extent of 5 amperes since 15 amperes is the allowable capacity. There is no rule which would prohibit the fusing of any other circuit of No. 14 wire to the extent of 15 amperes, such as a circuit to a motor or heating device requiring more than 660 watts.

On these same branch circuits and fuses No. 18 fixture wire is permitted by code rules, and this wire is only good for 3 amperes, therefore overfusing the wire to the extent of 7 amperes. The safe carrying capacity of this fixture wire is therefore exceeded by the allowable 10-ampere fuses in case of a short-circuit on the fixture, but usually the short-circuit current is large enough to blow the 10-ampere fuses. If 15-ampere fuses were substituted the probability of them blowing would be somewhat less, this probability, of course, depending upon the resistance of the conductor connected in the short-circuit, and if the fuses did not blow promptly overheating would result.

It is evident that the 10-ampere arbitrary allowable fusing of a branch circuit is a compromise between the conditions stated above. This compromise is further based upon the experience and opinions of inspectors who are well represented on the personnel of the committee responsible for the formulation of the National Electrical Code upon which many of the codes of cities and other regulatory bodies are based.

There is still another point, however. Any copper wire smaller than No. 14 is not mechanically strong enough to use for branch-circuit wiring without involving a certain degree of risk or hazard on account of the possibility of the wire breaking or its insulation becoming damaged during the process of installation. As far as the overheating of a wire is concerned, there is no reason for not permitting the use of a wire smaller than No. 14, and which would have a current-carrying capacity of just 10 amperes. The condensed reasons for the condition in question are: (1) a compromise of 10 amperes between the three conditions of overfusing the allowable wattage of the circuit, underfusing the No. 14 wire, and overfusing the fixture wire; (2) the opinions of inspectors based on experience, and (3) the mechanical limitations of wires smaller than No. 14.—A. W., Washington, D. C.

Answer.—While the fuse is required as a measure of safety it is oftentimes erratic in its behavior, occasionally operating prematurely and sometimes carrying for lengthy periods currents which much exceed its rated capacity. In fusing for any size of wire a safety margin should be allowed to give adequate protection. This margin being the difference between the rated capacity of the wire and that of the fuse which is to protect it.

The safety margin in the case of a circuit of No. 14 wire is 5 amperes, or the difference between the 15-ampere capacity of the wire and the 10-ampere rating of the fuse. As the rules allow but 660 watts to each circuit, a 10-ampere fuse is ample. A short-circuit or ground, if such should occur, might cause currents to flow which would have sufficient magnitude to heat and melt the fuse wire before the capacity of the wire was taxed, thereby offering real protection. Should the wire be fused for its rated capacity with a 15-ampere fuse and the conditions of short-circuit or grounding occur, there is no safe margin, and should the fuse be erratic in its behavior the wire itself would be heated before the fuse would offer any protection.

In a certain case known to the writer a lighting circuit became grounded through a screw in a rosette to a metal ceiling, burning off both wires and destroying the rosette. Had the circuit been properly protected with 10-ampere fuses instead of the 30-ampere fuses which were used, this trouble would probably have been averted.—W. F. P., Atlantic, Mass.

No. 507.—Armature-Winding Data.—I have a four-pole d-c. motor with an armature 2.5 ft. long by 1.5 ft. in diameter. It is wound with 150 coils and has a resistance of 0.5 ohm, the coils being arranged and connected as a lap winding. Will someone tell me what would be the safe voltage for this machine, and what the field flux should be? Will someone give a formula for finding the voltage of a motor with the resistance of the armature given and with a known flux in the field?—J. G., Chicago.

Answer.—The safe voltage for the machine in question is from 220 to 230 volts, and the field flux is approximately 7,000,000 lines. The motor voltage is found by multiplying the field flux by the number of armature conductors, multiplying this product by the speed in revolutions per second, multiplying again by the number of poles and dividing by the number of paths and by 100,000,000. To this value is added the product of the armature current and armature resistance in order to get the voltage of the motor.

Calculations are as follows: The circumference of the armature is 56.65 ins., the pole pitch

is 14.16 ins. and the pole arc is approximately 10 ins. The over-all armature length is 30 ins., so the active armature length is approximately 16 ins. Then the field flux will equal 10 times 16 times 45,000, or 7,200,000 lines.

The fact that there are 150 coils indicates, or suggests, that there are 75 slots and 75 commutator bars, or 18.75 bars between brushes. If the armature were for 125-volt service the voltage between bars would be 6.7 volts; for 230 and 550-volt service the voltage between bars would be 12.3 and 29.3 respectively. The latter value is too high so that the armature was probably built for 230 or 220-volt service.

The probable speed is calculated as follows, assuming the motor voltage as 220:

$$220 = 7.2(10)^6 \times 150 \times 2 \times \text{r.p.s.} \times (4/4) \times (10)^{-8}$$

$$\text{Speed} = 10.2 \text{ r.p.s.}$$
$$= 600 \text{ r.p.m., approximately.}$$

This armature probably belongs to a 75-hp., 230-volt, 600-r.p.m. motor. Its armature resistance ought to be 0.05 ohms.—L. A. D., Annapolis, Md.

No. 508.—Burned Laminations in Motor Armature.—I have a 5-hp., 1200-r.p.m., 220-volt d-c. motor the armature of which has been burned out by severe grounding of several coils. This grounding fused together the laminations in sections about 0.5 in. square in four different places. These spots are in different slots and each one affects a different set of laminations. Will it be safe to file out the slots to a smooth finish and rewind the armature, or should I secure new laminations and replace those that have been welded together?—A. L. S., Topeka, Kan.

Answer.—Induced electric currents, known as eddy currents, occur when a solid metallic mass is rotated in a magnetic field. They consume considerable energy, and often occasion a harmful rise in temperature. Armature cores, pole pieces and field-magnet cores are especially subject to these currents. For this reason armatures have a number of laminations or punchings, ranging from 40 to 66 to the inch, which brings the eddy-current loss down to about 1%.

The following case of armature trouble will prove that the above statement is correct: An armature had been burned out by lightning. The damaged coils were removed, the core was cleaned and scraped, and new coils were installed. The machine ran for several months when it burned out again in the same place. The second failure was attributed to poor repair work at this time. About twice as many coils were removed as before, and the machine was again repaired. Before it had a chance to fail again the operator noticed a smell of burning insulation, and on investigation found excessive heating which was confined to the repaired area. On removing the repaired coils inspection disclosed the fact that the insulation armor of some of them was being burned from the outside; the cotton insulation on the wires was in good condition, showing that the trouble did not come from within. The armature was stripped, the core disassembled, several inches of new laminations installed and the coils replaced. On drying out and again placing the machine in service no tendency to heat more in one place than another was exhibited.—T. F. M., Trenton, N. J.

No. 509.—Connecting Single Transformers in a Three-Phase Bank.—I have three single-phase, 5-kv-a. Westinghouse transformers, rated at 2200 to 220 and 110 volts, and want to know if I can use them connected together on a three-phase circuit and get 220 and 110 volts on the secondary side. If so, will someone please explain how to connect them and make a simple diagram for a guide?—R. L. G., Reynolda, N. C.

Answer.—Three-phase transformation may be accomplished by using three similar single-phase transformers connected in any one of four ways. In two of the methods the high-tension windings are connected in delta, the low-tension windings being connected either in delta or *Y* formation. In the second two methods the high-tension windings are connected in *Y* formation with a choice of either delta or *Y* connection for the low-tension windings as before.

In making the three-phase connections the current capacities of the individual transformers should not be exceeded to any appreciable extent, and the combination of connections which will accomplish this result as well as give the desired

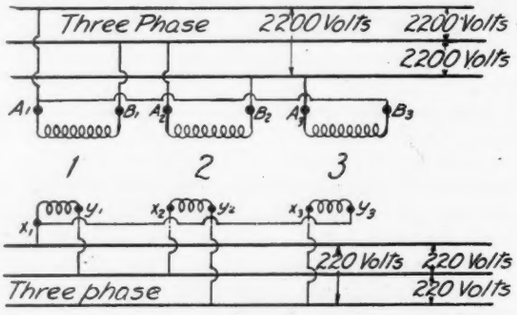


Diagram Showing Proper Method of Connecting Transformers.

voltage conditions is the one to be selected. As single-phase transformers the rated full-load current in the high-tension coils equals approximately 2.27 amperes with about 22.7 amperes in the low-tension coils.

If the high-tension sides of the transformers are connected in *Y* formation, each transformer will will be subjected to a voltage of only 2200 divided by $\sqrt{3}$ or 1270 volts. Under such conditions a current of 2.27 times $\sqrt{3}$, or 3.97 amperes would be required to develop the full rated capacity of the transformers. If the low-tension sides of the transformers are connected in *Y* formation, with the high-tension sides connected in delta, an undesirable pressure of 220 times $\sqrt{3}$, or 381 volts, is obtained. Full-load secondary current corresponding to this voltage is only 22.7 divided by $\sqrt{3}$, or 13.1 amperes. In view of these conditions it is evident that both the high and low-pressure sides of the transformers should be connected in delta formation. In case of a breakdown in one transformer the remaining two may be allowed to carry the load in open delta connection, but it must be remembered that each of these transformers will carry $\sqrt{3}$ times their normal load.

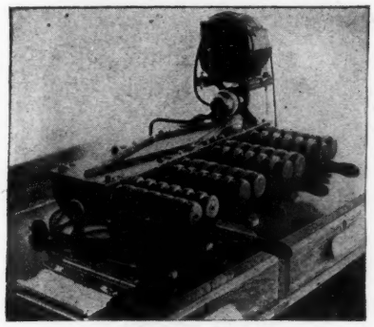
Before starting to make the connections care should be taken to see that the transformers are properly marked.—A. G. T., East Orange, N. J.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

Motor-Operated Razor Sharpener.

A machine for resharpening used safety-razor blades, embodying features not found in the usual type of machines for such service, has been developed by F. W. Cochrane, Los Angeles, Cal.

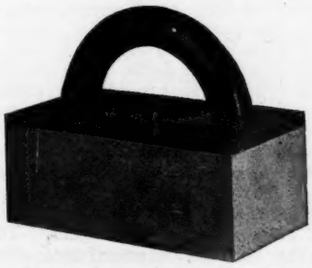


Razor Sharpener With Four Sets of Rollers.

The blades are moved laterally with reference to four sets of sharpening rollers. The first set of rollers is faced with felt, the second set is arranged as a honer, the third as a stroper, and the last set is faced with horsehide. These machines are made in sizes to accommodate either 6 or 12 blades at a time. The motors used are made by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.

Stone for Dressing a Working Commutator.

The use of commutator stones, instead of sanding or turning commutators, has grown quite rapidly. Large and small power companies, street and interurban railway companies, mining companies and industrial companies now recognize commutator stones as one of the essential parts of their equipment. Flat spots, high mica, high bars, ridges, or other rough spots can be removed quicker in many cases by the use of commutator stones than by other methods. The amount of copper removed is said to be much less than when the commutator is turned, and the stones can be used while the machine is carrying load.



Commutator Stone With Flat-Iron Handle.

To meet the demand for this equipment, the Martindale Electric Co., Cleveland, O., has developed a set of special stones provided with suitable handles, a stone with a flat-iron handle being shown in the accompanying illustration. Other stones are made with long handles and with knob handles to meet the different types of service requirements.

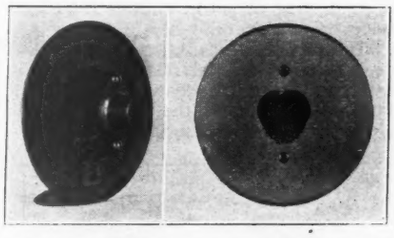
Stones are made in various grades and of both natural quarried material and artificially manufactured stone. The artificial stones are said to be more rapid, but are of a shorter life than the natural stones. Variation in fineness of the artificial stones makes them suitable for rough cutting, medium cutting, finishing, polishing or slip-ring cutting as desired.

Connections for Portable Lighting Equipment.

In order to meet a growing demand for detachable lighting equipment in the home Cantelo White, New York City, has developed a system of receptacles, plates and plugs to be used in the wiring of houses and the hanging of fixtures. The slogan "Hang your fixture like a picture!" has been given some prominence by fixture manufacturers, and this new set of devices is intended as a practical application of the spirit of the slogan. With this device perfected on a practical basis fixtures need be "fixtures" no longer. Electric chandeliers and wall lights may be moved from place to place as readily as an electric flatiron or other appliance.

Installing a Wall Bracket Without Use of Tools.

A new kind of plug with a new type of outlet to hold it are the essentials of the new device. The plug has curved blades, instead of the ordinary straight ones, and may be easily attached to any fixture. The outlet looks much like the usual baseboard plate, having two parallel slots in a rounded triangular center. When the plug is inserted in the outlet with the curved blades pointing upwards it forms the electrical and mechanical connections at the same time, and is strong enough to hold the heaviest household fixture. The outlet also will accommodate the standard parallel-blade plugs used with cord connections.



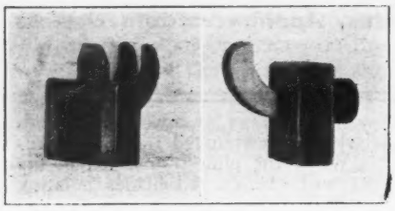
Front and Back Views of Ceiling Outlet.

Wall plugs of two types are made. For the smaller wall fixtures the plug is mechanically attached to the fixture bracket, and the latter is installed by simply sliding the prongs into the receptacle slots until the bracket is flush with the wall. For the more elaborate wall fixtures the prong plug is not attached rigidly to the fixture itself. In this case the wall fixture is hooked over the plug after it has been inserted in the wall receptacle. In wiring the plug to the light slack enough is left to allow the fixture to be readily hooked and unhooked with the plug in position. The ceiling outlet is provided with a brass flush plate.

With this new method of fixture installation outlets may be situated in the many various places in a room where lights might be needed. Generally more outlets would be installed than are needed under ordinary lighting circumstances. Thus, when a householder de-

Hanging a Suspended Chandelier Without Use of Tools.

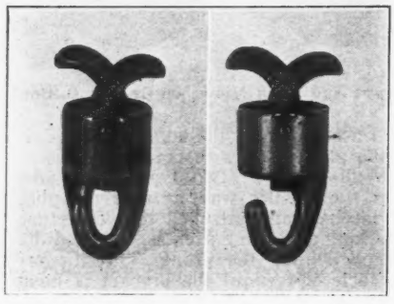
sires to shift a light from one part of the wall to another, or install it in another room, all he has to do is lift the fixture from the outlet at the old loca-



Wall-Type Plugs for Attachment of Brackets.

tion and plug it into another outlet wherever desired.

This new device is especially adaptable to use in hospitals and similar institutions. It does away with the limitations of fixed lights, the inconvenience of lengthy electric cords, the trouble and



Ceiling-Type Plugs for Fixture Attachment.

expense of wiring whenever lights are moved, and it facilitates the shifting of a light to suit the need of a patient, doctor or nurse. The device will be made by a number of manufacturers and will be on the market early in 1921.

Varnishes for Protection and Insulation.

A complete line of insulating varnishes and japans of various sorts, suitable for different applications in either the manufacture or upkeep of electrical apparatus, including the impregnation of coils wound with untreated fibrous materials such as tapes, yarns, etc., has been placed on the market by the General Electric Co., Schenectady, N. Y.

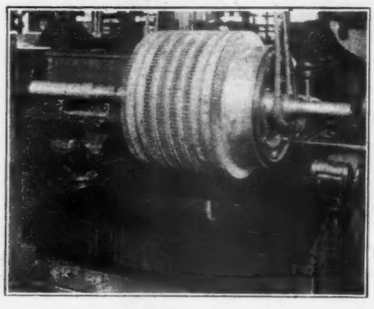
The varnishes are divided into two general classes known as black varnishes and yellow, or clear, varnishes. The former are made by compounding drying oils and asphaltic materials, producing a varnish of maximum insulation value, flexibility, and moisture resistance. Black varnishes may be further subdivided into two classes as baking and air drying varnishes. The latter are not ordinarily as durable, or flexible as the former because of the larger percentage of drying ingredients contained in them. The insulation value, however, is the same for both. The facilities for proper application are the features which should determine the choice of varnish.

The varnishes contained in the baking class are three in number, the first being suitable for general use. It produces a firm, hard film which is not easily injured during the assembly of apparatus, and has high dielectric strength, moisture resistance, and endurance. Films of any degree of toughness may be obtained by varying the baking period. It is adapted to use on all armature and field coils which are given a baked finish.

The second is a varnish which has a high gloss, being much used as a finish, and is particularly resistant to oils, even when immersed. The third is a plastic form which has high insulation resistance at high temperatures, and is permanent under prolonged heat and stress. It dries so as to produce a characteristic moistureproof glossy film, the degree of glossiness being directly proportional to the drying heat, and is adaptable to the manufacture of varnish fibers and papers.

The air-drying varnish is plastic, weatherproof and resistant to moisture, acid, or alkalies, and is suitable for finishing armature coils, compensators, motors and other apparatus which cannot be baked. It may also be used for a finish and rust preventive on metal parts. As a bonding material it has a better cementing value than shellac, as well as being a better insulator and having more heat resistance. It may be applied by either brushing, dipping or spraying.

Yellow varnishes are made from drying oils, which by oxidation produce hard films that resist abrasion, but are of less insulation and temperature-resisting power than the black. They are principally used where hardness of surface is the chief requisite. These varnishes are of two classes; first, a baking varnish which not only produces a film of high insulating qualities and flexibility, but will hold up under severe assembly and service conditions. It is especially adapted for insulating meter, transformers and regulator coils, being weather, water and oilproof and not affected by high temperatures. The second type is an air-drying variety suitable for use on commutator rings and



Armature About to be Dipped in Varnish.

for general insulation finish and repair work where it is impractical to bake the varnish.

Where a finished appearance is of prime importance, and only medium insulating qualities are desired, a third class of varnishes known as japans are used. They are made by combining drying oils and asphaltums, being classified according to the method of drying, whether by air or baking. Since the air-drying japans have a larger percentage of drying ingredients they are not as flexible or durable as the baking variety.

Insulating oils are classed with insulating varnishes owing to the similarity. The main difference is that they never contain any gum resins and are designed to give better life than clear insulating varnishes when subjected to heat. They are used in the preparation of sheet insulating materials such as oiled cotton, fibers, papers, etc.

Rheostat for Charging Batteries From Farm-Lighting Plant.

Users of farm-lighting equipment generally appreciate the importance of having simple charging rheostats of reliable construction for keeping their automobile batteries in good condition

Battery-Charging Rheostat for Use on 32-Volt Circuits.

in the spring and fall months. The charging rheostat shown in the illustration is said to stand up exceptionally well even under severe conditions of service, and is easily installed and operated. The name plate bears the directions for charging. The rheostat is connected in one of the lines from the 32-volt generating set and in series with the battery to be charged. A dial plate underneath the operating handle is marked to indicate the proper setting for charging certain numbers of cells. The handle is moved until the arrow is at the proper point on the dial plate, after which the battery circuit is closed and the charge begins. For example, when the line on the rotating dial between the lettering "6 cells, 12 volts" is in line with the arrow on the name plate, and the circuit is closed, charging will begin. For "3 cells, 6 volts" further turning of the knob brings the corresponding line to the arrow point. An ammeter to measure the charging current is not necessary as the current will be of the proper value (approximately 5 amperes) when the handle is in the right position.

The rheostat is small and compact, being about 6 ins. in diameter, and is readily mounted on any flat surface such as a switchboard or wall by means of three screws or bolts. The resistor wire is reflexed to provide for expansion, and is fastened to a special base of molded insulating material which will withstand a high temperature without cracking or chipping. The entire resistance element is covered with a special cement and sprinkled with sand which acts as a binding agent. This gives the rheostat a waterproof construction so that it may be used in moisture-laden places such as basements. The front of the rheostat is entirely inclosed in a ventilated pressed-steel frame. This rheostat, made by the Cutler-Hammer Manufacturing Co., Milwaukee, provides a means of charging small batteries from a 32-volt source of power.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Walstrum Armature Works, Birmingham, Ala., has increased its capital from $10,000 to $25,000.

Chattanooga Electrical Co., Main street, Chattanooga, Tenn., sustained a loss of $15,000 by fire Nov. 27.

Virginia Electric & Machine Works, Charleston, W. Va., has increased its capital stock from $50,000 to $100,000.

Lake Engineering Co., has announced the removal of its offices to 53 West Jackson boulevard, Chicago.

American Insulator Co., New Freedom, Pa., plans to erect a plant at Norwalk, Conn., which will employ 500 people.

Western Lighting Co., 292 Church street, New York City, manufacturer of electric lighting fixtures, sustained a loss by fire recently.

Transportation Engineering Corp., Chicago, has issued a booklet descriptive of the "Wanamaker" coated electrodes for arc welding.

Spray Electric Co., Inc., 144 East 58th street, New York City, manufacturer of electrical supplies, sustained a loss by fire last month.

ReQua Electrical Supply Co., Rochester, N. Y., manufacturer of electrical specialties, has increased its capital from $50,000 to $100,000.

Caldwell Electric Corp., Champaign, Ill., has issued in loose-leaf catalog form various folders descriptive of its line of electric lighting fixtures.

F. W. Wakefield Brass Co., Vermilion, O., has isued a leaflet on the Ivanhoe "Trojan" lighting unit with Wakefield "Red Spot" suspension.

Erie Electrical Equipment Co., 620 Elder street, Johnstown, Pa., plans to erect a foundry and factory for the manufacture of electrical apparatus.

Betts & Betts, Inc., 511 West 42d street, New York City, manufacturer of electrical specialties, has increased its capital from $50,000 to $100,000.

Canadian Metal Products Co., Guelph, Ont., has arranged with the Federal Electric Co., Chicago, for the manufacture of its washing machines.

Empire Lamp & Brass Manufacturing Co., Chicago, has issued its catalog No. 60, illustrating and describing the "Empire" line of portable lamps.

Copper Clad Steel Co., Rankin, Pa., has issued a folder which describes and illustrates the process of "Copperweld" manufacture and contains a comprehensive list of its uses.

Capital Electric Co., Salt Lake City, Utah, is now located in its new quarters which occupy 42,000 sq. ft. of floor space, utilized for showroom, warehouse and office purposes.

Canada Wire & Cable Co., Leaside, Ont., has bought the buildings erected by the United States Government for a munition plant in that city, and will use them in connection with its present operations.

Wagner Electric Co., Portland, Ore., plans to open a motor and equipment service station at 327 Flanders street.

Mutual Electric & Machine Co., Wheeling, W. Va., has increased its capital stock from $100,000 to $500,000.

Modern Electric Equipment Co., Bridgeport, Conn., has removed its plant from 249 State street to new quarters at 1110 Broad street, where increased facilities are provided.

Hygrade Lighting Fixture Corp., Brooklyn, N. Y., manufacturer of electric fixtures, has filed notice of increase in capital from $10,000 to $50,000 for proposed general expansion.

Youngstown Sheet & Tube Co., Youngstown, O., has distributed a 1921 calendar containing 12 two-color illustrations showing interesting processes in the manufacture of iron and steel.

Matthews Manufacturing Co., Sandusky, O., manufacturer of isolated electric lighting plants, plans to erect an addition to its factory at Monroe and King streets at an estimated cost of $75,000.

Irvington Varnish & Insulator Co., Irvington, N. J., has announced that it has effected an adhesive paper tape with high mechanical and dielectric strength. This paper is used for taping coils and general repair work.

Western Appliance Manufacturing Co., Seattle, Wash., plans to erect a one-story plant for the manufacture of an electrical appliance known as the Mercer ironing machine. C. M. Mercer is secretary of the company, which has established headquarters in the Railway Exchange building, Seattle.

Acheson Graphite Co., Niagara Falls, N. Y., has issued a 60-page booklet on electric furnaces, which covers descriptions furnished by the various manufacturers of electric furnaces in the United States, Canada and Europe. It also includes the electric heat-treating and annealing furnaces now on the market for high temperature work. At the end of the booklet the different types of electric furnaces described are listed.

Novelty Electric Sign Co., 165 Eddy street, San Francisco, has leased a one-story and basement building at 435 Turk street for extensions to its electric sign manufacturing business.

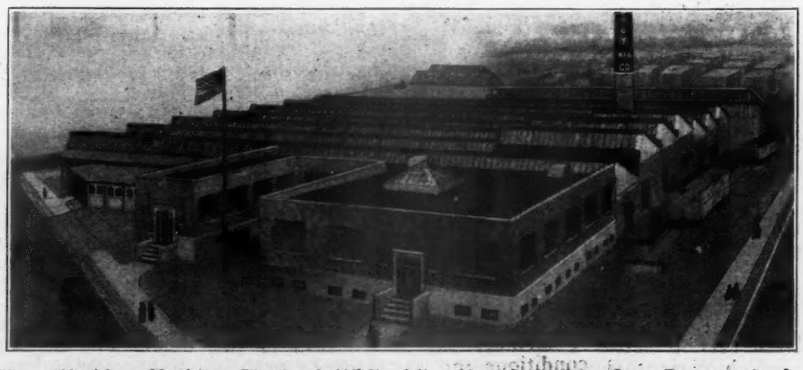
Bleadon-Dun Co., Chicago, has issued literature covering a plan to help the dealer sell "Violetta" electric outfits. The company is also distributing two pamphlets explaining the uses of violet rays in treating various human ailments.

J. H. Bunnell & Co., 32 Park place, New York City, has issued catalog No. 28 containing descriptions and illustrations of its telegraphic and other electrical apparatus, together with detailed and extensive lists of supplies and tools.

Electrical Engineers Equipment Co., 35 South Desplaines street, Chicago, manufacturer of line and station equipment, has issued a folder on its heavy duty insulating supports designed to carry rectangular copper bars in the form of a hollow square or in a manner which approximates copper tube conditions.

Imperial Electric Co., 58 Temperance street, Toronto, Can., has announced that it has taken over the business formerly carried on by Brooks & Kearns, electrical brokers, 125 Simcoe street, Toronto. The company will specialize in tungsten, nitrogen and other types of incandescent lamps, and will also deal in standard electrical appliances and accessories.

White Lily Manufacturing Co., Davenport, Ia., manufacturer of the dolly and cylinder type washing machines for hand, gas engine and electric power, has recently erected a plant to increase production of the "White Lily De Luxe" full cabinet washer. The new factory covers over 60,000 sq. ft. of floor space and is built on the latest improved models, with sawed-tooth roof. The engraving shows the offices at the right, the club rooms in the center and the garage and factory office on the extreme left. The departments are so arranged that raw material enters in at the receiving room, goes through the machine shop, tin shop, assembly de-



New Washing Machine Plant of White Lily Manufacturing Co., Davenport, Ia.

partment, finishing room, and finally through the shipping room, where it is loaded directly into the freight car.

Bower & Bartlett Co., Baltimore, manufacturer of washing machines, has leased property at 1201 South Sharp street for a manufacturing plant.

Bemis Co., 139 North Clark street, Chicago, has announced that it is prepared to give engineering and accounting service on public utility and industrial valuations and appraisals, as well as general engineering service.

Yates & Johnson Manufacturing Co., Chippewa Falls, Wis., manufacturer of electro-generating units, has changed its name to the Northlite Manufacturing Co. and increased its capital from $25,000 to $100,000, for expansion.

American Cement Products Co., 3248 Long Beach avenue, Los Angeles, Cal., has issued a catalog illustrating and describing "Marbelite" reinforced concrete lighting standards manufactured by the company for street and other public and private uses.

Ilg Electric Ventilating Co., Chicago, manufacturer of self-cooled motor propeller fans, blowers, exhausters, automatic shutters and air-conditioning apparatus, has issued a sales-plan book for the dealer under the title of "New Roads to Steady Profits," which sets forth the opportunities offered for the sale of Ilg ventilating equipment.

George Cutter Works of Westinghouse Electric & Manufacturing Co., South Bend, Ind., has issued bulletin 7-A-C-1 describing its new locomotive headlights for 23 to 94-watt lamps recently placed upon the market. Among the features outlined in the bulletin are the cast-iron construction, gas-proof cover, spring suspension of the lamp and cast-iron housing for the resistance unit.

Cushman Electric Co., Concord, N. H., illustrates and describes in a 32-page booklet its line of variable speed motors and motor drives for industrial and other purposes. The drives are designed to form an inseparable part of the tools to be driven and are placed in the position formerly occupied by the belt drive. The company has also issued a booklet covering linotype motors of the "Cushman" patented offset type.

Safety Car Heating & Lighting Co., 206 Erie street, Jersey City, N. J., manufacturer of railway car-lighting equipment, has completed the removal of its plant to its new works at New Haven, Conn., comprising a number of buildings formerly occupied by the Marlin-Rockwell Corp. The lamp and mantle department is still being operated at the Jersey City works, and will not be removed to the new location until the spring of the coming year, when suitable quarters will be arranged for occupancy under increased output.

Dodge Sales & Engineering Co., Mishawaka, Ind., has published a catalog on its standardized elevators and conveyors, which includes tables giving maximum conditions for the different carrying parts. A feature of the catalog is the simple manner in which designs involving gearing are worked out, whereby data, whether for a conveyor, elevator or other speed reduction, can be obtained from the tables.

Virazone Co., Detroit, has issued a folder illustrating and describing its "Virazone" violet ray-ozone electrical device for treating human ailments and for other purposes. This instrument is claimed by the manufacturer to transform ordinary electric current into violet rays and ozone. The device can be attached to any electric light fixture.

Robbins & Myers Co., Springfield, O., has issued an illustrated booklet entitled, "Putting Your Fans on the Profit Side of the Counter," which has been compiled for the benefit of the dealer, containing suggestions for dealer-advertising and window display in connection with "R. & M." fans. In a publication designated "Domestic Catalog No. 1153," the company sets forth the features of the design and construction of its electric fans for alternating and direct-current circuits of the non-oscillating, oscillating, ceiling and ventilating types.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., in order that engineering students of the University of Pittsburgh and the Carnegie Institute of Technology may be able to gain practical knowledge regarding the production and testing of electrical apparatus, and at the same time earn extra money, has initiated a part-time employment plan. For the most part the employment consists of storekeeping, which allows the students to become familiar with the size and character of the different kinds of electrical apparatus.

Western Electric Co. has established a factory at 1601 Glenwood avenue, Philadelphia, for the manufacture of electrical precision products for measuring the most minute currents. The new instrument shop occupies a four-story building containing about 60,000 sq. ft. of floor space. The personnel will consist of about 900 employes. D. A. Wallace, formerly chief draughtsman at the Chicago factory, is assistant superintendent of the new shop, stationed at Philadelphia, while F. W. Willard, the new plant's superintendent, will continue to be located at the Hawthorne works.

Metropolitan Electrical Supply Co., New York City, manufacturer and jobber of electrical supplies, lighting fixtures and glassware, is now located in its new five-story building at 41 West 36th street. The main floor is used as a salesroom and for the display of lighting fixtures. The basement and fourth floor are set aside for stock rooms, the assembling of fixtures being done on the top floor. A simple arrangement to expedite service and save labor is the operation of a dumbwaiter between the basement stock rooms and the sales floor.

Erner Electric Co., Cleveland, electrical supply jobber, entertained the Cleveland Woman's Advertising Club Nov. 9 at an electrically-cooked dinner. George S. Milner, general manager, spoke on the value of electrical household appliances as labor-savers, and Frank B. Rae, Jr., gave a talk on the opportunity for the advertising woman in this field. The manufacturer's problem of overcoming woman's natural aversion towards machinery, and the fact that this difficulty is overcome by advertising the appliances from the woman's point of view, were features of both talks.

General Electric Co., Schenectady, N. Y., has plans under way for the erection of a manufacturing plant on Elmwood avenue, between 68th and 70th streets, Philadelphia. The works will consist of a main six-story building, 80 by 600 ft., to cost about $500,000 with machinery. The plant will be devoted principally to the manufacture of switchboards and kindred apparatus.

Cooper Hewitt Electric Co., Hoboken, N. J., has issued technical bulletin No. 102 by L. J. Buttolph, of the engineering department, on the Cooper Hewitt quartz lamp and ultra-violet light. This bulletin treats briefly of a large subject, but is particularly valuable on the points covering the importance of the mercury arc in quartz as a source of ultra-violet light, and the bibliography given on previous publications on this subject. The company has also issued bulletin No. 86 on the Cooper Hewitt quartz lamp laboratory outfit.

Cutler-Hammer Manufacturing Co., Milwaukee, in a leaflet known as publication 862, entitled, "Electric Heating of Air," illustrates and describes the C-H convector type of electric air heaters. The leaflet also tells briefly the advantages of electric heat over other forms of heating and gives thumb rules which enable the customer to closely estimate the number or size of heaters required for any particular installation. The C-H convector type of air heater consists of several of the widely known C-H space heaters mounted horizontally between cast-iron end plates and completely inclosed in a protecting screen of perforated sheet metal, so that nothing inflammable can touch the heaters or any live parts. The heaters are made in eight different capacities ranging from 1 to 5 kw. for standard commercial voltages, and all except the smallest and largest sizes are designed for three different heats.

Electric Furnace Co., Alliance, O., has announced that it has recently shipped two 105-kw. Baily units to Norway, where they will be used to melt zinc and aluminum. Complete rolling-mill brass-melting furnaces, designed for pouring the metal directly into the molds, have been shipped to the Amsinck Corp. of Mexico, Mitsui & Co. of Japan and Allen Everett, Ltd., of England. In addition to these units, Baily electric furnaces have recently been installed in three Canadian plants, the Dominion Steel Products Co., Brantford, Ont.; the Monarch Metals Co., Hamilton, Ont., and the Union Screen Plate Co., Lennoxville, Que. An automatic heat-treating set is being installed by the Electric Furnace Co. at the new plant of the C. H. Willys Co., Marysville, Mich. The set is designed to treat automobile parts and consists of a 200-kw. hardening furnace, a motor-operated quench and a 200-kw. drawing furnace. A 200-kw. Baily annealing furnace is being installed at the Springfield plant of the Ohio Steel Foundries Co., and a similar outfit, but with a 300-kw. electrical capacity, has been ordered for export to Norway.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Old Town, Me.—The Bangor Railway & Lighting Co., Bangor, has completed plans for extensions and improvements to its substation and electrically operated pumping station at Old Town, to cost about $17,000.

Manchester, N. H.—The Manchester Traction, Light & Power Co. has increased its capital from $3,864,000 to $4,250,000. The proceeds will be used for new construction and general financing.

Rutland, Vt.—The Vermont Hydro-Electric Corp. is making a connection with its 13,000-volt transmission system at its new Glenn power plant, tying in the high-tension lines for improved service at Rutland and vicinity. A higher water head is being developed at the Glenn plant. The Springfield, Vt., substation has been improved to be automatic in operation. All load-dispatching work is now being handled from the company substation on Cleveland avenue. Other improvements are under way for increased service.

Boston, Mass.—The Boston Elevated Railway Co., Massachusetts avenue, has filed a petition with the state legislature for permission to expend $4,421,000 for the erection of an electric generating station and repair shops. The power plant will be used for increased service, and with equipment for other features of operation, is estimated to cost $1,421,000. The new shops will be located at Everett, Mass., and will be equipped with electrical and mechanical apparatus for all features of repair and construction work. The different buildings with machinery will cost about $3,000,000. Plans are now being prepared by Dwight P. Robinson & Co., engineers, 125 East Forty-sixth street, New York.

Cambridge, Mass.—The Charles A. Cook Co., 16 Osborn street, will make extensions and improvements in its power house. In connection with a one-story plant extension to be erected, the work will cost about $30,000.

Charlestown, Mass.—The Charlestown Gas & Electric Co. has awarded a contract to the William M. Bailey Co., 88 Broad street, Boston, for the erection of a one-story and basement substation, 36 by 53 ft.

Fall River, Mass.—The Fall River Gas & Electric Co. has been granted permission by the state department of public utilities to issue new capital stock to an amount of $700,000, the proceeds to be used for extensions and betterments in plant and system.

Brooklyn, N. Y.—The Kings County Lighting Co., New Utrecht avenue, has completed plans for the erection of a generating plant at 5402 1st avenue, to cost about $25,000. Ralph Elsman is president.

Buffalo, N. Y.—Millard F. Bowen, Buffalo, and associates are planning the construction of a high-tension electric system extending from a point on Lake Erie, near Buffalo, to Olcott, and following Lake Ontario to Pulaski. Later it is proposed to extend the system to the vicinity of Lake Oneida. Application has been made to the Federal Power Commission, Washington, and to the local board of supervisors.

Esopus, N. Y.—The Kingston Gas & Electric Co. of Kingston, has petitioned the New York State Public Service Commission to construct an extension to the power plant in Esopus.

Gowanda, N. Y.—The Iroquois Utilities Corporation, City Bank building, Syracuse, has completed plans for the erection of its proposed electric generating station at Gowanda. Permission for the construction was recently granted by the public service commission. B. H. Shepard is president.

Lewiston, N. Y.—The Niagara Power & Development Co. has filed notice of increase in capital from $50,000 to $375,000 for proposed expansion.

New York, N. Y.—The New York Edison Co., 15 Duane street, has acquired property at 224-26 East 52nd street and 227 East 51st street; it is said that the site will be used for a substation.

North Tonawanda, N. Y.—The board of aldermen is negotiating with the Tonawanda Power Co. for the installation of a number of ornamental street lamps in the vicinity of the state bascule bridge over Tonawanda creek. The conference also covers the installation of street lamps in different parts of the city, and the extension of the company's system along Ruie road, to service the residents of this section. Improvements are under way in the local fire alarm system, to include the erection of a number of new standards in important parts of the business section.

Poughkeepsie, N. Y.—The Central Hudson Gas & Electric Co. has filed notice of increase in capital from $2,600,000 to $3,500,000 for general expansion.

Troy, N. Y.—All bids for the proposed hydroelectric power plant to be constructed on Green Island, near Troy, by the Ford Motor Car Co., Detroit, Mich., will be taken through Stone & Webster, Inc., 147 Milk street, Boston, engineer for the project. Plans have been prepared and it is understood that bids will be asked at an early date. The station will be used for the operation of the company's new tractor plant in this section.

Watertown, N. Y.—Work on the construction of a dam for the proposed municipal hydroelectric power plant has been inaugurated. Plans are nearing completion for the station, and exact character of equipment installation will be determined at an early date. The structure will be about 45 by 170 ft. Paul B. Sutton is consulting engineer for the project.

Allendale, N. J.—The board of public utility commissioners has granted permission to the Rockland Electric Co. to advance its base rate for electrical energy from 13 to 15.5 cents per kw-hr., effective Dec. 1. In its petition the company set forth that the increased revenue was necessary for proper operation, as well as proposed and necessary betterments. The company is affiliated with the Rockland Light & Power Co., New York, and furnishes service at Allendale, Ramsey and vicinity.

Newark, N. J.—The local chamber of commerce has retained counsel in an effort to prove the proceedings up to the present time regarding a municipal electric power plant as illegal. The project was voted by citizens at the last election. The action will be heard in the supreme court. For some months past, since the project was inaugurated, the chamber of commerce has been opposed to the enterprise. The city commission is in favor of the plan, and will contest the forthcoming action. Preliminary plans for the plant, to be operated in conjunction with the city waterworks at the Pequannock watershed, are now under way. The plant will cost in excess of $8,000,000. Director Raymond, department of streets and public improvements, is in charge.

Perth Amboy, N. J.—The board of aldermen is considering the installation of a white-way street-lighting system on Madison avenue in the business section. Property owners are negotiating with the city for the improvement.

Harrisburg, Pa.—The City Council has arranged for the installation of a number of new lighting standards in North 3rd street. Commissioner S. F. Hassler is in charge.

Hazleton, Pa. — The Pennsylvania Power & Light Co., is planning the operation of its new power plant at Hauto early in 1922. Throughout the coming year work will be pushed on the project, which forms an extension to the present plant at this location. The station with machinery is estimated to cost close to $3,000,000. It is said that when the generating station is ready for service the Wilkes-Barre & Hazleton railways will discontinue the operation of its present plant and purchase power for the operation of its traction line.

Jeanette, Pa.—Fire, Dec. 1, destroyed a portion of the plant of the American Window Glass Co., including power equipment, with loss reported at about $10,000.

Philadelphia, Pa.—The Public Service Commission has ordered the Philadelphia Suburban Gas & Electric Co. to make extensions and betterments in its plant and system. The company

is permitted to retain present rates for service, operative since Oct. 15, 1919, until June 1, 1921, when an investigation and appraisal of the company's property will have been completed, allowing the commission to make a final determination.

Reading, Pa.—The city council is planning the installation of an electrically operated water purification system, to cost about $600,000. Emil L. Neubling is city water engineer.

Baltimore, Md.—Electrical and mechanical hoisting and conveying machinery, traveling cranes, etc., will be installed by the department of public works at the new piers and docks to be constructed by the city. The city council has approved a bond issue of $2,700,000 for securing sites and other incidental work, and $10,000,000 for the construction and equipment.

Cambridge, Md. — The Eastern Shore Gas & Electric Co. has made application to the public service commission for permission to increase its capital stock by $408,500, the proceeds to be used in part for proposed extensions and improvements in its electric power plants and system.

Frederick, Md. — The Frederick Electric Railway Co. has tendered a proposition for the purchase of the plant and system of the Antietam Gas, Electric Light & Power Co., Antietam, Md. The latter company has been having difficulty in developing sufficient power for local requirements, and has been negotiating for the purchase of power from neighboring utilities. The proposition for purchase is before the public service commission.

Washington, D. C.—The Capital Traction Co. has presented a proposition to the Public Utilities Commission for the construction of a new traction line to serve the northwest districts. The line will be laid on Fifteenth street, Vermont avenue, Madison place and Pennsylvania avenue, and with electric equipment is estimated to cost about $1,000,000. John H. Hanna is vice-president and general manager.

Washington, D. C.—Proposals will be opened Dec. 22 in the supervising architect's office of the Treasury Department for separation of the sanitary from the storm water drainage system and for permanent light and power feeders at the United States auditor's building, out-buildings, etc.

Washington, D. C.—The Potomac Electric Power Co. has plans under way for the erection of an electric generating station. It is proposed to inaugurate construction in 1921 and to have the plant ready for service in 1922. William F. Ham is president.

Charlestown, W. Va.—The Northern Virginia Power Co. is planning to inaugurate operations at its new steam-electric power plant, now in course of construction in this district, early in January. Final work is now under way by the Sanderson & Porter Co., New York, in charge of construction. Connection with the new plant will be made at one of the stations of the Hagerstown & Frederick Railway Co., at Millville, and a new transmission line constructed for this purpose.

Kingwood, W. Va.—The Carleton Mining & Power Co., is planning the erection of an electric power plant at its properties.

Morganton, N. C.—The Catawba Valley Light & Power Co., care H. L. Millner, has applied for preliminary permit from the Federal Power Commission to construct dam, conduit, power house and transmission lines on Wilson creek, Caldwell county, North Carolina.

Mortimer, N. C.—The United Mills Co., Hickory, N. C., is planning the erection of a hydroelectric power plant at Mortimer. A distributing system will also be constructed for local light and power service. H. J. Holbrook is secretary.

NORTH CENTRAL STATES.

Burton, O.—The Burton Public Service Co. has been given authority to issue common capital stock in the sum of $8200, the proceeds to be used in the construction of transmission lines from Middlefield to Burton, O., and to improve the distribution system in Burton.

Marion, O.—The Columbus Delaware & Marion Electric Co. has been authorized to issue $200,000 in capital stock; such stock to be sold for not less than 70 per cent of the par value thereof and proceeds to be used towards providing additions, extensions and improvements.

Georgetown, Ind.—Millon Bros. of Lake Cicott, have purchased the mill here for the purpose of utilizing the power at the dam to generate electricity.

Atlanta, Ill.—The Atlanta Electric Light and Power Co. has filed a petition with the Illinois Public Utilities Commission for permission to issue notes to the amount of $10,000.

Chicago, Ill.—The Sanitary District of Chicago, 900 Harper building, plans to erect a power house at 128-168 East 125th street, at an estimated cost of $530,000.

Marion, Ill.—J. M. Lines, contractor, has been awarded a contract for the erection of a "white way" street-lighting system.

Fond Du Lac, Wis.—The Great Northern Power Co., of which W. N. Ryerson is manager, is preparing plans for a power plant and dam of about 50,000-hp. on the St. Louis river, 1.75 miles above the concrete bridge. The cost is estimated at $1,500,000.

Janesville, Wis.—The Wisconsin River Power Co. has applied for a franchise to extend its transmission lines throughout the city.

Two Rivers, Wis.—The city council will have street lamps installed on intersection of 18th and Garfield streets; 20th and Garfield streets; 18th and Lincoln streets; 21st and Lincoln streets; 22nd and Monroe avenue, and 25th and west River street. Arthur Zander, city clerk, is in charge.

Duluth, Minn.—The Great Northern Power Co. is making plans for the construction of a power plant on the St. Louis river to cost $2,000,000. A new dam and plant will be built about 1.75 miles above the new concrete bridge at Fond du Lac and about two miles below the company's present plant at Thompson.

Cedar Rapids, Ia.—The city will improve its street-lighting system by installing tungsten lamps from K avenue west, north of Penn avenue and from River to Eleventh street.

Davenport, Ia. — The city is contemplating installing lights on Commodore and Concord streets; Arlington and Columbia avenues, and Cary avenue and Laurel street. L. W. Christensen is city clerk.

Keokuk, Ia.—The Mississippi River Power Co. has plans for installing a transmission line from the power dam to Ft. Madison, 21 miles, to operate at 30,000 volts.

Peru, Neb.—Bonds in the sum of $10,000 have been voted for the purpose of purchasing and improving the local electric light and power plant. The city clerk is in charge.

Randolph, Neb.—Bonds in the sum of $18,000 have been voted for electric light improvements. Ray J. Kirk is city clerk.

SOUTH CENTRAL STATES.

Taylorville, Ky.—The city council has plans under way for the erection of a municipal electric power plant.

McAlester, Okla.—The officials of the Pittsburgh County Railway Co. operating the local and interurban lines out of this city to Krebs, Haileyville and Hartshorne, announce that it is contemplated to extend the interurban lines from their present terminus to Ft. Smith, Ark.

Amarillo, Tex.—T. B. Slaughter and associates are organizing a company to construct a hydroelectric generating plant in the Palo Duro Canyon district, about 20 miles from this city. With dam and power station construction, including electrical machinery, the project is estimated to cost close to $1,000,000. The local municipal authorities are interested in the enterprise.

El Paso, Tex.—The El Paso Electric Railway Co., is arranging for an expenditure of over $1,000,000 for extensions and betterments in its plant and system. An addition will be constructed to the local generating station, with installation to include a 7500-kw. turbine, estimated to cost $785,000, with auxiliary operating equipment; new switches and other apparatus in the switchboard department to cost $10,000; additional transformers to cost $30,000, and other work. A new short line will be constructed for greater power supply to cost about $60,000. A number of new cars will be purchased, and improvements made in the traction lines.

Hallettsville, Tex. — The lighting committee of the town council is planning the installation of new engine equipment and auxiliary apparatus at the municipal lighting plant, to cost about $20,000. Bonds have been voted.

WESTERN STATES.

Cody, Wyo.—L. R. Ewart, president of the Home Colony, (an association of citizens) has made application to the Federal Power Commission for a license to construct a small dam, 400-ft. conduit and small power house on Kitty creek, Park county, Wyoming, for community use.

Spokane, Wash.—The Flathead Valley Electric Co., Old National Bank building, plans to construct power

house and transmission lines on the Flathead river at the lake outlet, Flathead county, Montana, for public utility purposes.

Hoquiam, Wash.—The city will install a boulevard lighting system in the business section.

Vancouver, Wash.—An application for a permit to construct a power house, reservoir, etc., at Toutle river and Spirit lake has been made by the Spirit Lake railway. Joseph Roane, 110 East Twelfth street, is president.

Jefferson, Ore.—J. H. Cunningham, consulting engineer, Portland, is making preliminary plans and estimates for a proposed hydroelectric plant on Santiam river at this place, to develop about 1500 hp.

Salem, Ore.—The Klamath Meadows Co. of Ft. Klamath has applied to Percy A. Dupper for permission to appropriate 70 sec. ft. of water from Anna creek for the development of power. The cost is estimated at $50,000.

Scio, Ore.—The installation of a 50-kw. hydroelectric plant has been completed. This involved the building of a rubble concrete dam on Thomas creek, nine miles east of Scio, the construction of ditch, flume and a 30-in. wood-stave penstock, and the installation of a 100-hp. Smith water turbine, which operates under a 53-ft. head, driving a General Electric generator. Energy is transmitted to the town over a 6600-volt line. J. H. Cunningham, Portland, was engineer for the municipality.

El Centro, Cal.—An ornamental lighting system on Main street and on several other streets is being contemplated.

Fresno, Cal. — The San Joaquin Light & Power Corp. has plans under way to construct a power house, transmission line, etc., on the San Joaquin river in Fresno and Madera counties, California. The company also contemplates the construction of dams, reservoirs, diversion conduits and a power house on the north fork of the Kings river, Fresno county, both projects being for public utility purposes.

Los Angeles, Cal. — The Southern California Edison Co., care G. C. Ward, Edison building, has applied to the Federal Power Commission for a preliminary permit to construct seven dams and reservoirs, six diversion dams, 12 conduits and five power houses at the headquarters of the San Joaquin river in Madera and Fresno counties, California, for pubilc utility purposes.

Los Angeles, Cal.—The department of public service, 603 Knickerbocker building, has plans under way to construct five dams and reservoirs with tunnels and conduits leading to four houses on the South and Middle Forks and on Kings river, Fresno county, California. The project is designed for public utility purposes.

Los Angeles, Cal.—The Southern California Edison Co. has applied to the Federal Power Commission for a license to construct a diversion dam and conduit leading from Horse creek into Salmon creek; also dam and storage reservoir on Salmon creek to regulate the flow of water to the company's plants on the Kern river.

Los Angeles, Cal.—G. J. Kuhrts, general manager of the city traction lines, has outlined plans for improvements to the supply of electrical power for operating the street railway system, and the building of two new substations, at an estimated cost of $100,000. Over $25,000 will be expended for the installation of new feeder cable and other improvements to voltage conditions in various sections of the city.

Merced, Cal.—The Merced Irrigation District (a municipality) has applied to the Federal Power Commission for a preliminary permit to construct a dam at Exchequer on the Merced river for irrigation and power purposes.

San Benito, Cal.—The Coast Valleys Gas & Electric Co., care Chickering & Gregory, 1232 Merchants Exchange building, San Francisco, plans to construct a transmission line in the vicinity of San Benito to provide power for the quicksilver mines.

San Diego, Cal.—Albert A. Samsen, master mechanic and electrical engineer, has advocated the development of 10,000-hp. along the city water system by utilizing the force of the water in city conduits.

San Francisco, Cal.—The Utica Mining Co., 1128 Merchants Exchange building, has made application to the Federal Power Commission for a license to carry out a power development project on the Stanislaus river.

San Francisco, Cal.—Frank B. Pattee, Samuel Bernhard and J. T. Ross, care Edward R. Solinsky, Call building, have applied for a preliminary permit from the Federal Power Commission to construct a dam, reservoir, conduit, power house and 100-mile transmission line on the north fork of the Stanislaus river in Calaveras and Tuolumne counties, California.

San Francisco, Cal.—The Nevada-California Power Co., care W. L. Huber, First National Bank building, has applied for a license from the Federal Power Commission for two power plant projects in California for public utility purposes.

Stockton, Cal.—The Western States Gas & Electric Co. has applied to the Federal Power Commission for a license to construct conduit, power house and transmission line in the Trinity National Forest, in Trinity and Humboldt counties, California.

CANADA.

Carman, Man.—It has been voted to extend the hydroelectric power line to Carman.

Montreal, Que.—The development of 240,000 hp. on the Quince river is being planned by the Riordan Pulp & Paper Co.

INCORPORATIONS.

East Orange, N. J.—Triangle Electric Co. To operate a local electrical business. Incorporators: Harold and John Lang, 103 North 18th street.

Providence, R. I.—Richardson Electric Co. To operate a local electrical works. Incorporators: Lloyd S. Richardson, 132 Pitman street, and others.

Providence, R. I.—Robbio Electric Co., 195 Dean street. To operate a local electrical works. Incorporators: Anthony Robbio, 126½ Arthur avenue, and others.

Newark, N. J.—O'Brien Storage Battery Co. To operate a works at 87 Halsey street. Incorporators: David F. O'Brien, 350 Belleville avenue, and others.

Milwaukee, Wis.—Sprecher Manufacturing Co. Capital, $100,000. To manufacture lighting fixtures, etc. Incorporators: Peter W. Sprecher and others.

Charlestown, W. Va.—Dixie Storage Battery Co. Capital, $100,000. Incorporators: A. E. Hayes, Roy Pennywitt, Andrew Gardner and others.

Chicago, Ill.—Inland Specialty Co. Capital, $25,000. To manufacture electrical and mechanical toys. Incorporators: F. O. Singer, M. Spoland and N. L. Wellins, 1460 North Robey street, Chicago.

East Chicago, Ind.—O. K. Giant Battery Corp. Capital, $10,000. To manufacture electric storage batteries. Incorporators: B. F. Stone, W. F. Speedy, E. E. Messick, E. W. Wickey and Leo McCormack.

Milwaukee, Wis. — Lincoln Light Corp. Capital, $250,000. To manufacture generating equipment. Incorporators: James Mahler, 219 28th street, Milwaukee, and others.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Accessories (34,013)—An engineering equipment company in Wales desires to purchase electrical accessories, such as conduit pipes, ceiling roses, cutouts, lamp holders, switches, fancy shades and porous pottery. Quotations should be given c. i. f. Welsh port. Reference.

Electrical Appliances (34,044)—A firm of manufacturers' agents in South Africa desires to secure an agency on a commission basis for the sale of electrical goods, such as heating and cooking appliances, fans, lamps, wiring appliances and fittings.

Electrical Equipment (34,045)—A company of commercial representatives in Mexico desires to secure exclusive agencies for the sale of electrical equipment, such as generators and supply parts. Quotations should be given c. i. f. Mexican ports, or f. o. b. American ports. Catalogs are requested. No reference offered.

Electrical Supplies (34,029)—A commercial agent in Australia wishes to be placed in communication with manufacturers who desire representation throughout that country for the sale of electrical, mechanical and railway supplies of all kinds. Reference.

Electric Furnace (34,019)—A merchant in Mexico desires to purchase one electric furnace for fusing limestone for the manufacture of calcium carbide. Catalogs, prices and full information are requested. Quotations should be given c. i. f. El Paso, Tex. Cash to be paid. Reference.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Allis-Chalmers Manufacturing Co.

Reports for the nine months ended Sept. 30, show net profits. $2,525,287; preferred and common dividends, $1,679,296; surplus, $845,991; previous surplus, $10,856,007; total surplus, $11,701,998. The company reported net profits for the six months ended June 30 last of $1,599,631. Deducting this amount from the total of $2,525,287 reported for the nine months will make the net profits for the third quarter of the year $925,656. This is considerably over the average quarterly

Issue of Brooklyn Edison Gold Bonds Sold.

The Guaranty Co. of New York and a syndicate offered Dec. 6 an issue of $5,000,000 Brooklyn Edison Co. 20-year general mortgage series "D" 7% gold bonds at 97.375 and interest, to yield about 7.25%. The bonds were sold and the books closed shortly after the sale opened. The increasing demand for Brooklyn Edison service has necessitated the expenditure for additions, extensions and improvements from Oct. 1, 1912, to Oct. 31, 1920, of over $21,500,000. Against this additional investment only $13,000,000 par value of securities have heretofore been issued. The proceeds of this issue will be used further to reimburse the company for expenditures so made and to provide funds for additional similar expenditures.

Offering of Niagara Falls Power Co. Bonds.

Spencer Trask & Co., E. H. Rollins & Sons, Chicago, and Schoellkopf, Hutton & Co., Buffalo, are offering an issue of $4,000,000 Niagara Falls Power Co. 30-year first and consolidation mortgage series AA 6% gold bonds, at 87.5 and interest, to yield over 7%. The Niagara Falls Power Co. owns and operates all the hydroelectric power plants on the American side of the Niagara river at Niagara Falls and controls the power plant on the Canadian side of the falls owned and operated by the Canadian Niagara Power Co. The present aggregate installed generating capacity of the four generating stations on the American side of the falls is approximately 373,500 hp. and the additional 112,500 hp. installed in the generating stations of the Canadian Niagara Power Co. brings the aggregate of the system plants up to 486,900 hp. Plans have been perfected for a combined capacity of about 620,000 hp.

Notes of New York Utility Offered to Public.

A new issue of $25,000,000 one year 8% notes of the Consolidated Gas Co. of New York was offered Dec. 6 by the National City Co. and associates at par. These notes are not only a direct obligation but are secured by a pledge of $34,000,000 par value of the capital stock of the New York Edison Co., on which present annual dividends exceed the amount required for interest on the notes.

Lighting Plant Bonds Offered to Public.

The National City Co., New York City, is offering an issue of $150,000 of Brigham City, Utah, 20-year electric light 6% bonds, at 100 and interest, to yield 6%. These bonds are issued for the purpose of constructing a lighting plant.

New England Co. Power System.

	1920.	1919.
September gross	$ 558,811	$ 382,672
Net after taxes	109,771	134,667
Surplus after charges	41,933	69,721
Twelve months' gross	5,702,385	3,979,222
Net after taxes	1,612,558	1,408,196
Surplus after charges	826,606	639,387

Virginia Railway & Power Co.

	1920.	1919.
October gross	$ 990,504	$ 811,308
Net earnings	245,542	294,612
Total income	260,444	309,305
Surplus after charges	74,833	70,353
Four months' gross	3,744,929	3,104,506
Net earnings	938,726	1,213,842
Total income	992,621	1,272,005
Surplus after charges	216,026	349,277

Utah Securities Corp. Subsidiaries.

	1920.	1919.
October gross	$ 748,717	$ 640,704
Net earnings	355,196	317,746
Twelve months' gross	8,271,446	7,175,516
Net earnings	3,927,394	3,702,958

Southern Utilities Co.

	1920.	1919.
October gross	$ 189,748	$ 173,380
Net after taxes	24,344	35,035
Total income	24,390	35,217
Surplus after charges	6,190	18,769
Twelve months' gross	2,531,460	1,882,202
Net after taxes	463,198	193,812
Total income	464,252	194,992
Surplus after charges	247,521	9,297
Balance after preferred dividends	247,225	9,297

Consumers Power Co.

	1920.	1919.
September gross	$1,209,032	$ 940 282
Net after taxes	242,786	294,195
Surplus after charges	65,069	158,796
Twelve months' gross	13,605,688	10,807,418
Net after taxes	4,172,727	3,933,465
Surplus after charges	2,202,367	2,201,142
Balance after preferred dividends	1,427,902	1,431,476

Northern States Power Co.

	1920.	1919.
October gross earnings	$1,081,099	$ 897,840
Net earnings	376,231	354,752
Twelve months ended Oct. 31:		
Gross earnings	11,277,738	9,605,741
Net earnings	4,346,011	4,090,734

Carolina Power & Light Co.

	1920.	1919.
September gross	$ 135,215	$ 102,305
Net after taxes	30,932	25,646
Total income	68,408	61,750
Surplus after charges	50,218	45,886
Twelve months' gross	1,523,605	1,153,407
Net after taxes	424,614	381,715
Total income	595,476	540:448
Surplus after charges	392,147	349,912
Balance after preferred dividends	258,217	223,909

Commonwealth Power, Railway & Light Co.

	1920.	1919.
September gross	$2,653,562	$2,144,857
Net after taxes	579,456	694,592
Deficit after charges.	6,679	*152,111
Twelve months' gross.	30,157,335	24,641,508
Net after taxes	8,848,246	8,367,510
Surplus after charges	2,010,690	1,918,098
Balance after preferred dividends	933,510	840,918

*Surplus.

Idaho Power Co.

	1920.	1919.
October gross	$ 169,536	$ 143,942
Net after taxes	64,658	60,026
Total income	76,316	65,005
Surplus after charges	24,670	25,532
Twelve months' gross	2,250,175	1,737,710
Net after taxes	1,172,224	833,029
Total income	1,271,818	889,452
Surplus after charges	762,992	433,007
Balance after preferred dividends	679,236	371,787

Dividends.

	Term.	Rate.	Payable.
Cons. G. El., L. & P. com.	Q	2%	Jan. 3
Elec. Stor. Batt. com.	Q	$3.00	Jan. 3
El Paso Elec.	Q	$2.50	Dec. 1
Niagara Falls Pr. pfd.	Q	$1.75	Jan. 15
N. Y. Edison	Q	1.75%	Dec. 14
Okla. Gas & El. pfd.	Q	1.75%	Dec. 15
Tricity R. & L. pfd.	Q	1.50%	Jan. 3

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Nov. 30.	Bid Dec. 7.
Adirondack Electric Power of Glens Falls, common	6	13	12
Adirondack Electric Power of Glens Falls, preferred	6	73	73
American Gas & Electric of New York, common	..	100	99
American Gas & Electric of New York, preferred	6	35½	34
American Light & Traction of New York, common	..	105	108
American Light & Traction of New York, preferred	6	79	78
American Power & Light of New York, common	4	48	47
American Power & Light of New York, preferred	6	61	60
American Public Utilities of Grand Rapids, common	..	6	6
American Public Utilities of Grand Rapids, preferred	7	19	18
American Telephone & Telegraph of New York	..	..	98½
American Water Works & Elec. of New York, common	..	2½	2
American Water Works & Elec. of New York, particip	7	5	5
American Water Works & Elec. of New York, 1st preferred	..	42	39
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	15	18
Cities Service of New York, common	+extra	270	265
Cities Service of New York, preferred	6	64	64
Commonwealth Edison of Chicago	8	102	101
Comm. Power, Railway & Light of Jackson, common	..	13	11
Comm. Power, Railway & Light of Jackson, preferred	6	34	33
Federal Light & Traction of New York, common	..	7	6
Federal Light & Traction of New York, preferred	..	46	46
Northern States Power of Chicago, common	..	41	40
Northern States Power of Chicago, preferred	ex.div.7	77	76
Pacific Gas & Electric of San Francisco, common	..	48½	48
Public Service of Northern Illinois, Chicago, common	7	62	61
Public Service of Northern Illinois, Chicago, preferred	6	82	80
Standard Gas & Electric of Chicago, common	..	12	11
Standard Gas & Electric of Chicago, preferred	8	35	33
Tennessee Railway, Light & Power of Chattanooga, common	..	½	½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	2½	2
Western Power of San Francisco, common	..	19	19
Western Union Telegraph of New York	extra	87	86
Industrials—			
Electric Storage Battery of Philadelphia, common	4	100	99
General Electric of Schenectady	8	126	125
Westinghouse Electric & Mfg. of Pittsburgh, common	7	48	48